Some Effects of Certain Diets upon Excretion by the Kidneys and upon the Blood

BY

R. S. AITCHISON, M.D., F.R.C.P.E.

PRINTED FOR THE AUTHOR BY

TURNBULL & SPEARS, EDINBURGH

1896

PREFACE

IN printing this work, which was a Thesis accepted for the degree of Doctor of Medicine at Edinburgh University, the author feels that it is desirable to make a few explanatory statements.

The original intention was to investigate certain abnormal symptoms, alluded to in the introductory remarks, and to make observations upon the metabolism of the tissues. As the observations proceeded, it became evident that defects existed in the Poorhouse diets, and hence the obvious conclusion that the correction of these should be made the ultimate object of the investigation. To the general reader, however, who may not be specially interested in this subject, and who may be misled by the introductory notes into the belief that nothing more is aimed at than a parochial reform, it is necessary to state that the observations made upon the inmates of the Poorhouse are of physiological interest as shewing the influence of certain dietetic agents upon the nitrogenous equilibrium (*vide* p. 67 *et seq.*). The observations could not have been made upon any other class, as it was necessary to secure subjects in a state of *physiological bankruptcy*—as paupers generally are when they seek admission. The application of modern physiology to the practical question; the restoration of the nitrogenous equilibrium by the correction of the diets; the relations of the latter, when corrected, to Von Noorden's valuable work; and the suggestiveness of the effects of these diets upon the urea elimination—are all of practical interest to the physician.

In the original work, a chart was printed and placed opposite each case. It has been found more convenient to

divide the chart, and to place the diagrammatic portion at the end of the work, while the remainder will be found incorporated with the text. In these charts it will be noticed that the "weight at the end of the *month*" (top of right hand corner) has been printed as in the original; but as, sometimes, the subject of the observation left before the month was completed, the weight recorded is that at the end of the *observation*.

74 Great King Street,
Edinburgh, *November* 1896.

CONTENTS

IN the "Rules and Regulations for the Management of Scottish Poorhouses," issued by the Local Government Board, a set of diets has been formulated for the use of the inmates. These diets are subject to the approval of the Medical Officer, so far as individual cases are concerned; but adherence to their main lines is expected when dealing with numbers. The dietary of the *hospital* cases, again, is a matter entirely for the Medical Officer, and it is not within my experience—now extending to eight years—to record the slightest interference with it, on the part of either the Local Government Board or the Parish Council.

I desire more particularly to consider the question of the regular and ordinary diets of that large class of paupers who, after admission, pass into the hands of the parochial authorities, and are dieted according to the rules of the Local Government Board. The Medical Officer is not supposed to interfere with them or with the rules, and it is only in the event of illness that he is consulted. On admission these inmates are not suffering from any serious organic diseases, and, generally speaking, they have (if anything) only temporary functional disorders, the result of their own habits of living. Excepting always the infirm and the hospital cases, very few seem to seek relief in the poorhouse who are the victims of real misfortune; and by far the larger number of this unfortunate class are subjects given to alcoholic excesses, and who do not appreciate the "dignity of labour."

When the Poor Law Act of 1845 was passed, and subsequently, we can well believe—before Dickens came to the rescue—the dietary of our poorhouses and workhouses was of a very wretched character. These days are long passed away, and the attempt (fairly successful, I believe) was made to nicely balance a proper feeling of humanity, against the pockets of indifferent ratepayers. I do not propose, however, to enter into any question of parochial politics, or to discuss the *character* of the ordinary pauper. It is sufficient to say that a scale of diets has been prepared for paupers not suffering

from any marked or special diseases, which was thought sufficient for them, and fair to the honest labouring classes who were struggling to support themselves and families by their own exertions.

I have not been able to discover any record of any scientific investigation made upon the subject. I am led to believe that purely empirical methods were used, and that ordinary "labouring" diets of the time were taken as a gauge of the requirements of the pauper. At that time buttermilk was used by the labouring class. Will any one say that it is still used from choice, to any great extent, by that class? I do not say that buttermilk is totally unfit for food, especially *if quite fresh;* but I quote the article as an instance which may throw some doubt upon the wisdom of leaving things as they are without further discussion.

There were two stronger reasons why I should make an exhaustive enquiry—(1) the anæmic condition of the paupers themselves, and (2) the very frequent complaint of *increased micturition*, attributed by them to the porridge and buttermilk diet. (The latter symptom is also present in the case of the inmates of the Calton Prison, who have similar diets.)

Their anæmic condition suggested that perhaps the food was insufficient in quantity, or deficient in iron; and the mild form of polyuria, present in most cases, pointed to some radical defect in the construction of the diets. If the polyuria was accompanied by increased urea excretion, as it often is, and if the output of nitrogen was considerably in excess of that taken in the food, there would be good reason for believing that their debilitated condition was largely due to this cause—the consequent disturbance of the nitrogenous equilibrium, at the expense chiefly of the muscular tissues.

On the other hand, the parochial diets might not be entirely responsible for their condition, seeing that many paupers arrive at the Poorhouse in a debilitated and "broken down" state; and sometimes leave it within a few days, looking much improved.

Believing, then, that the improved methods of modern times make it possible to put these matters upon a firmer basis, I have begun this work, with a view of ascertaining (1) the relative and exact nutritive values of the different diets used; (2) the amount of iron in the foods prescribed; and (3) the effects of these diets in maintaining our poor in health, and more especially the effects upon the excretion of the kidneys. Observations have also been made upon the quality of the

blood, at intervals, in relation to the amount of iron in the food, and the general anæmia present in almost all of the inmates.

I shall place before you the details of the diets in question, and the manner in which I have analysed the two diets, one or other of which forms the base upon which all the other diets are constructed. They are the two lowest diets. Then follows the series of observations made upon 40 to 50 paupers during 1895-96, comprising generally the examination of the urine for 30 consecutive days, and the blood at intervals over two or three months. A chart has been prepared, and placed opposite each case, giving a summary of the detailed facts collected.*

I propose, at the end of the observations, to discuss the various questions raised, and then to suggest the remedies by which the abnormal conditions may be alleviated or overcome. Some of the suggestions will require the sanction of the Local Government Board, but as these suggestions are few, and can hardly be deemed revolutionary, I have reasonable hopes of securing it. Many of the abnormal conditions may be improved without any infringement of the rules, as they stand at present—the rules allowing of a sufficient margin, of which it is possible to take advantage.

Irrespective of these important practical considerations, the application of modern physiology to the correction of the defects of these diets, is of some scientific interest. The charts prepared show the relations of the urea excreted, with the amount of urine voided each day, and likewise the relations of body-weight to the nitrogen taken in, and excreted.

With regard to the examination of the blood, it was not expected that such examination would reveal anything of special interest. I am aware that in acute starvation, the hæmopoietic system is by no means the first to suffer. Indeed, in Hösslin's experiments upon starving dogs, quoted by Von Noorden (Lehrbuch der Pathologie des Stoffwechsels), while the animals diminished in weight, the blood-corpuscles were found increased in number, and the hæmoglobin raised in *percentage*. The same has been found in *acute* starvation in man. This apparent increase is, of course, due to a concentration of the blood-serum, and *not* to an increased formation of corpuscles and hæmoglobin. In *chronic* starvation, or rather, I should say, in individuals who have had poor nourishment over a long period of years, there is no such concentration of

* The diagrammatic portions of the charts are appended in this print.

the blood as is produced in acute starvation, and hence the enumeration of the corpuscles, and estimation of the hæmoglobin, have been undertaken, merely to check the improvement, or otherwise, produced on subjects living on these diets.

I have been careful to select my cases from the ordinary pauper class, not suffering from weak digestive powers, or from any wasting disease. They would describe themselves as "perfectly well," although sometimes a few would complain of general debility ; but if their symptoms, in the latter respect, were deemed severe, they were rejected, and put under treatment in the usual way.

They were all what I may cali "healthy paupers," yet in hardly a case I examined did I find the blood corpuscles and hæmoglobin normal—the blood being almost always reduced in quality. It is interesting to observe the improvement, sometimes, in this respect, which takes place when the subject has been kept upon a fairly good and wholesome diet, even although a limited one.* It has not been found practicable to extend the series of *consecutive* observations, over a period of more than a month in each case ; and it has been unfortunate for the investigation, sometimes, that the law allows of an inmate of the Poorhouse dismissing himself, or herself, by giving twelve hours' notice—an unfortunate law, also, for the *intemperate* pauper.

I have used the Thoma-Zeiss hæmocytometer, and Gower's hæmoglobinometer in estimating the quality of the blood.

These instruments certainly leave room for errors in the estimation, but every care has been taken to avoid them. The blood has been slowly drawn into the capillary tubes to the mark I, and the points of the tubes have been carefully wiped. With the hæmocytometer the cover-glass has been carefully adjusted, and in the counting of the corpuscles, 40 to 60 squares have been counted, as a rule. Frequently, and especially when in any doubt, the whole operation has been repeated two or three times. Hayem's solution was used to dilute the blood. With the hæmoglobinometer, the distilled water has been added, a few drops at a time, and the two tubes were then compared, the graduated markings being turned out of the line of sight to prevent shading. The two tubes were compared with the light shining directly upon them, then the light behind them, and then over white paper. Whatever fallacies may be inherent to the instruments themselves, at all events

* These improvements have been found to be only temporary, as regards the hæmoglobin.

the *relative* value over the whole series of observations, should not be much affected. Care has been also taken to educate the subjects of the observation. They were instructed to adhere closely to the diet ordered (an almost unnecessary precaution in the case of paupers), and to avoid large draughts of water at any time, but more particularly upon the day on which the blood was to be examined. Any diarrhœa or vomiting was to be intimated.

The *specific gravity* of the blood has not been recorded, but in each case a drop was tested, in prepared solutions of 1,057 and 1,059 sp. gr. to show that there was no concentration of the blood, before counting the corpuscles, and estimating the hæmoglobin. The reason for this was rendered more necessary, in relation to the withdrawal from the body of such large quantities of fluid by the kidneys, as made the supposition possible. In no case did the blood ever sink in the fluid of 1,059 sp. gr.

Reserving all discussion of these introductory remarks, I shall now enter into the details of the pauper diets.

THE DIETS.

The Local Government Board Rules declare that "no article of diet which is not of good quality, and in a wholesome state, shall be issued, prepared for, or given to any inmate of a Poorhouse." In my experience this rule has been faithfully kept, and the quality of the oatmeal, bread, broth, beef, sweet milk, and beef tea—these being the articles of diet concerned in this investigation—are beyond doubt good and wholesome. The buttermilk also is delivered regularly, and it always appeared to be quite fresh.

The Contracts for these articles are carefully examined by the Parish Councillors, Inspectors, and Governors of the Poorhouses, in Committee—some of the Councillors (generally) being connected with trades to which the articles of diet, directly or indirectly, belong. I can speak highly of the wholesome quality of the food-stuffs used at Craigleith Poorhouse, and beyond, sometimes, a great objection to the buttermilk, I have rarely heard of even a pauper complaining of the food-stuffs used in preparing their diets.

It is only necessary to give the details of the following *two* diets, viz. :—

Diet No. 1.

This is the lowest diet which may legally be given to any inmate. It is intended for "adults of either sex, who are *healthy*, but not working, and who are not aged persons." The word *healthy*, which I have italicised, must be held to mean that slight departure from health which is the occasion of their being admitted to the Poorhouse, as no pauper can be admitted if his medical certificate bears that he is in *good* health.

The diet consists of the following, viz. :—

Breakfast—4 ounces of oatmeal, making a large bowl of porridge ; and buttermilk ¾ pint, imperial.

Dinner—8 ounces of bread ; and 1½ pints of broth (made with 2 ounces of beef exclusive of bone, 2 ounces of barley, ½ ounce of peas, 1½ ounces of carrots, and a due quantity of salt).

Supper—Porridge and buttermilk, as in the breakfast.

Diet No. 2.

This diet is given to those who cannot take porridge twice daily. It is also the right of aged persons who do not like porridge. It is (like No. 1) a "no work" diet. It consists of the following, viz. :—

Breakfast—As in No. 1 diet.

Dinner—6 ounces (not 8) of bread ; 1½ pints broth (as in No. 1 diet).

Supper—6 ounces of bread ; tea, ½ pint imperial. The tea is made with ½ ounce of sugar, 1 ounce new milk, and tea ⅛ ounce for each half pint imperial.

These two diets (No. 1 and No. 2) each forms a basis for all the diets, and it is only necessary to order No. 1 or No. 2, *plus* the extras, to form the "working" diets. The only *extras* we are concerned with are beef, beef-tea, and sweet milk. Four ounces of beef are allowed to all persons, of either sex, who are working. The work is of a very light description, such as acting as a warder in the hospital, or making up small bundles of firewood. Sometimes they seem to do a fairly good day's work as tailors, shoemakers, and joiners, &c. I am informed, however, that the *quantity* is far below the standard of regular tradesmen. The women are chiefly engaged in sewing and laundry work ; and they act also as warders and cleaners.

It should be mentioned that Diets No. 1 and No. 2 are

subject to change *twice* a week, as regards the broth, by Pea Soup replacing it.

No. 2 diet, with ½ pint sweet milk for the buttermilk, and ½ pint beef-tea (made from 4 ounces lean meat) is a common diet for aged and infirm people, not suffering from any disease of a wasting character, and who are not doing work of any kind.

The Hospital diets are under the control of the Medical Officer, and we are not concerned with them at present. Care has been taken to keep the subjects of the observations strictly to one or other of the two diets mentioned above, with or without the extras, for the reasons explained in my introductory remarks.

As it is necessary to calculate out and consider the quantities of Proteids, Fat, and Carbo-hydrates contained in the diets, and to estimate the quantities of Nitrogen and Carbon which the various ingredients yield, I have compiled the following table for the purpose. The figures have been compared, and taken from the standard works—*Bunge*, *G. N. Stewart* and *others*. The Buttermilk is taken from *Hunter Stewart's* special analyses of many different samples, obtained from the Poorhouses in Midlothian, and elsewhere. The calories of the different diets are estimated in a table at the end of this section.

In every hundred (100) grammes

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Of Oatmeal .	13	5·5	65	=	2·6	40·3
,, Lean Meat	21	3·5	0	=	3·4	13·5
,, Peas (dried)	22	2·0	55	=	3·5	35·7
,, Wheat flour	12	2·0	70	=	2·3	39·8
,, Milk . .	4	4·0	5	=	0·6	7·0
,, Rice . .	5	1·0	83	=	0·9	36·6
,, Potatoes .	2	0·15	21	=	0·4	10·5
,, Fat . .	0	100·	0	=	0·0	73·3
,, Carrots .	1·1	0·2	9	=	0·1	4·6
,, Barley . (average)	13	2·	67	=	2·0	34·
,, Buttermilk*	2·4	·026	2·3	=	0·3816	0·9684
,, Skim Milk .	3·6	0·98	4·3	=	0·5724	1·8105

From these figures, the diets may be calculated thus :—

* *Note.*—The Nitrogen is calculated from 15·9% Nitrogen in the Casein ; the Carbon from 144 Carbon in 342 parts Milk Sugar.

Diet No. 1.

(*Lowest Adult Scottish Pauper's Diet.*)

	Grammes of	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
Breakfast and Supper	8 ounces (226 grammes) oatmeal	29·3	12·4	146·9 =	5·8	91
	1½ pints (851 *c.c.*) buttermilk	20·4	0·2	19·5 =	3·2	8·2
Dinner	8 ounces bread* = 5·89 ounces (166·9 grammes) wheat flour	20·0	3·3	116·8 =	3·8	66·4
	1½ pints (851 *c.c.*) broth = 2 ounces (56 grammes) meat †	...	...	...	...	...
	2 ounces (56 grammes) barley	7·2	1·1	37·5 =	1·1	19·0
	½ ,, (14 ,,) peas	3·0	0·2	7·7 =	0·4	4·9
	1½ ,, (42 ,,) carrots	0·4	0·0	3·7 =	0·0	1·9
	Total Grammes . .	80·3	17·2	332·1 =	14·3	191·4

Pea soup is given *twice* weekly for the broth. It is composed of 28 grammes of vegetable (varied), 56 grammes of peas, and 42 grammes of pease meal. Its value equals

	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
Grammes . . .	22	2	55 =	3·5	35·7
As compared with broth	10·6	1·3	48·9 =	1·5	25·8

As this difference in value is considerable, and would affect the estimation of the calories, it is necessary to take the average over the week—thus, five days' No. 1 diet with the broth, as estimated, equals

Grammes of	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
	401·5	86	1660·5 =	71·5	957
And two days with pea soup . .	183·4	35·8	676·4 =	32·6	402·6
Total in days 7)	584·9	121·8	2336·9 =	104·1	1359·6
Average daily .	83·5	17·3	333·8 =	14·8	194·2

Therefore, the average value of Diet No. 1 *daily, equals*

	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
Grammes . . .	83·5	17·3	333·8 =	14·8	194·2

There is slightly over 100 ounces of water in this diet. (No. 1.)

* A sack of flour = 280 lbs., makes 95 loaves of 4 lb. each.

† It will be noticed that no values are extended for the meat in the broth. Large pieces of meat are boiled in the broth and then they are removed, and when cold, cut up into four-ounce lots for the workers. An inmate upon No. 1 diet (non-working) is not entitled to have the two ounces of meat left in the broth. The simple boiling of meat in this way, imparts little or no nourishment to the broth, hence no values are calculated out.

Diet No. 2.

(Optional Pauper Diet—Scotland.)

	Grammes of	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
Breakfast	4 ounces (113 grammes) oatmeal	= 14·6	6·2	73·4	= 2·9	45·5
	¾ pint (425 *c.c.*) buttermilk	= 10·2	0·1	9·7	= 1·6	4·1
Dinner	1½ pints broth, as in No. 1 diet	= 10·6	1·3	48·9	= 1·5	25·8
	6 ounces bread = 4·42 ounces (125·3 grammes) wheat flour	15·0	2·5	87·7	= 2·8	49·8
Supper	6 ounces bread (as above)	15·0	2·5	87·7	= 2·8	49·8
	½ pint tea = tea ⅛ ounce	... Traces		...	...	...
	Sugar ½ ounce (14 gram.)	...	...	14·	= ...	5·8
	Milk 1 ounce (28 gram.)	1·1	1·1	1·4	= 0·1	1·9
	Total grammes	66·5	13·7	322·8	= 11·7	182·7

As pea soup is given *twice* weekly, in this diet, as in No. 1, the average must again be taken, thus—5 days of Diet No 2, as above, equals

Grammes of	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
	332·5	68·5	1614·0	= 58·5	913·5
2 days with pea soup	155·8	28·8	657·8	= 27·4	385·2
Total in days 7)	488·3	97·3	2271·8	= 85·9	1298·7
Daily average in Diet No. 2 equals	69·7	13·9	324·5	= 12·2	185·5

There is about 75 ounces of water in Diet No. 2.

EXTRAS.

The remaining articles of the dietary, used in this investigation, are *Extras*, added to No. 1 or No. 2 diets, to form the "working" or "Infirm" diets. These extras are as follows, viz. :—

Beef (4 Ounces).

Four ounces of beef includes about one ounce of fat; hence—

Grammes.		Proteids.	Fat.		Nitrogen.	Carbon.
85	Lean Meat	17·8	2·9	=	2·8	11·4
28	Fat	...	28	=	...	20·4
Total grammes in *Beef* =		17·8	30·9	=	2·8	31·8

Beef Tea (½ Pint).

Each half pint is made from 4 ounces of lean meat ; but no nutritive value can be attached to it, beef-tea being merely a stimulant, composed of beef extracts.

Sweet Milk.

½ pint (=284 *c.c.*)	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
	11·3	11·3	14·2	=	1·7	19·8

Rice Soup made from—

Grammes.			Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
85	Lean meat	=	17·8	2·9	...	=	2·8	11·4
28	Fat .	=	...	28·0	...	=	...	20·4
42	Rice .	=	2·1	0·4	34·8	=	0·3	15·3
56	Vegetables (varied)	=	...Traces...		(say) 4·0	=	0·0	2·0
	Total grammes in *rice soup* .		19·9	31·3	38·8	=	3·1	49·1
	If the beef be afterwards removed the value is then = approx. :—		2·1	0·4	38·8	=	0·3	17·3

Notes.—*Diet No. 1* is the lowest in grade, (although *not* in nutritive value, as these figures now show) ; and it is the diet to which all non-working paupers are entitled.

Diet No. 2 is the next higher in grade, and it is simply the substitution of six ounces of bread and a half pint of tea, for the porridge and buttermilk of the supper. It only allows, *then*, *six* ounces of bread at dinner, instead of *eight* ounces as in the No. 1 diet.

Both of these diets are for *non-workers* ; but the addition of four ounces of beef makes them the "working" diets.

No. 2 diet with *beef tea*, and a *sweet milk* for the buttermilk, is a common "Infirm" diet for paupers doing no work, and not suffering from any wasting disease. *Rice soup* is not an extra immediately concerned with the investigation ; but it is put in for the purpose of understanding some remarks, to be made later. Rice soup is often allowed to the infirm of either sex.

Many of the aged get an additional 12 grammes fat, in the ½ ounce *butter* often allowed at tea (supper).

There is also a rule in the "Local Government Board Regulations" which *allows* of *all* inmates, working or non-working, "receiving 12 ounces *white fish*, not oftener than *twice*

weekly," in place of *broth*. This rule, however, has not been enforced for some time, and *no* fish has been given during the course of my investigation.

We are only concerned with the Diets No. 1 and No. 2 (non-working); and No. 1 and No. 2 + beef (working); and only slightly with the "Infirm" diet, which is No. 2, with beef tea; and sweet milk for the buttermilk. Care has been taken to give the details of these diets with exactness.

I shall now calculate from the same *percentage* figures, the quantities of proteids, fat and carbo-hydrates, contained in the lowest diet of Scottish prisoners. I find (1) that prisoners sentenced to more than 3 days and not exceeding 2 months (males) and 6 months (females)—have 2 ounces oatmeal *more* daily, but 2 ounces of bread, and $\frac{1}{4}$ pint buttermilk *less*, as compared with the pauper diet; (2) after 2 months (males) and 6 months (females) the diet is still upon the same lines, but the quantities are increased from 10 to 13 ounces oatmeal (paupers having only 8 ounces)—and the broth is increased from $1\frac{1}{2}$ to 2 pints, the bread being now raised to 8 ounces; (3) after a period of 6 months has been served, 14 ounces oatmeal and 12 ounces of bread are allowed *per diem*. All prisoners, after 4 months, get 12 ounces white fish, every Friday, instead of the broth. The broth also *contains* the meat used in the making, hence the higher value of the broth as compared with that of the pauper's diet. The most interesting for my purpose is to calculate the value of the 1*st diet*, *viz.*: the Scottish prisoner's lowest diet—"working," but not heavy labour:—

	Grammes of	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
Breakfast and Supper	10 ounces (283 grm.) oatmeal	36·7	15·5	183·9 =	7·3	114
	$1\frac{1}{4}$ pints (709 *c.c.*) buttermilk	17·0	0·1	16·3 =	2·7	6·8
Dinner	6 ounces bread (125·3 grm. flour)	15·0	2·5	87·7 =	2·8	49·8
	$1\frac{1}{2}$ pints broth (851 *c.c.*)	19·4	16·7	48·9 =	2·9	41·6
	Total grammes	88·1	34·8	336·8 =	15·7	212·2

As the prisoners get pea soup *three* times weekly, an average has to be taken as in the pauper's diets. Thus:

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
4 days as estimated =	352·4	139·2	1347·2	=	62·8	848·8
3 days with pea soup =	272·1	60·3	1028·7	=	48·9	618·9
Total in days 7)	624·5	199·5	2375·9	=	111·7	1467·7
Average daily =	89·2	28·5	339·4	=	15·9	209·6

Occasionally, 2½ lbs. (1132 grammes) of potatoes are given, with ¾ pint of buttermilk, for dinner—in place of the broth and bread. This "potato dinner" yields with buttermilk, 6·1 nitrogen, and 122·9 carbon as compared with "broth dinner," 5·7 nitrogen, and 91·4 carbon.

Referring now to standard works on Physiology, I may quote the following:—

RANKE, weighing over 11 stones, found that he could keep in health and maintain his weight upon daily :—

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grms.	100	100	240	=	14	230

and these figures are approved by *Foster*, as those nearest to a healthy average.

PETTENKOFER AND VOIT found that a workman of 11 stones weight, required daily 19·5 grammes nitrogen and 283 grammes carbon, during *rest*—the carbon requiring to be increased to 356 grammes when at *work*. Thus :—

	Grms. of Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
(at rest)	137	72	352	=	19·5	283
(at work)	137	173	352	=	19·5	386

The "Table of Diets" used in the Materia Medica Class Rooms, Edinburgh University, gives the following, viz :—

	Proteids.	Fat.	Carbo-hydrates.
A "no labour" diet = in grammes . .	70·7	28·3	339·6
A "moderate labour" diet = in grammes	129·8	83·8	403·4

A German soldier's diet in the field =

Grms. of Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
151	46	522	=	(say) 21	340

G. N. Stewart in his Manual of Physiology (just published) considers the following to be a *liberal* diet for a hard-working labourer, weighing about 11 stones.

Grms. of Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
140	100	350	=	20	300

Stewart also quotes the following, which when calculated out to Nitrogen and Carbon, will be useful for comparison, viz :—

Grms. of	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
A "hard work" Prison diet =	104	38	521 =	(say) 14·8	311·2
A "no work" Prison diet =	87	22	305 =	(,,) 12·4	195
A "Starvation" diet . =	54	29	292 =	(,,) 7·7	178*

We may now construct a *Table* of these diets, beginning with the "Starvation" diet, and ending with the most *liberal*, or largest diet. The *Calories* of the different diets are calculated out, taking the values of Proteids and Carbo-hydrates at 4·1; and the Fat, at 9·3; so that the total values of the diets may, at a glance, be ascertained—

TABLE OF THE DIETS.—CALORIES.

Grammes of	Proteids.	Fat.	Carbo-hydrates.	Nitro-gen.	Carbon.	Calories.
A "Starvation" diet	54	29	292 =	7·7	178	= 1688·3
A "no work" Scottish Pauper diet—No. 2 (optional) . .	69·7	13·9	324·5 =	12·2	185·5	= 1745·3
A "no work" Munich Prison diet . .	87	22	305 =	12·4	195	= 1811·8
A "no work" Scottish Pauper diet—No. 1 (lowest and legal) .	83·5	17·3	333·8 =	14·8	194·2	= 1871·6
"Light work" Scottish Prison diet .	89·2	28·5	339·4 =	15·9	209·6	= 2022·2
A "working" Scottish Pauper diet—No. 2 (optional) . .	87·5	44·8	324·5 =	15	217·7	= 2105·7
A "working" Scottish Pauper diet—No. 1 (lowest and legal) .	101·3	48·2	333·8 =	17·6	226	= 2232·0
Ranke's diet (moderate work) . .	100	100	240 =	14	230	= 2324·0
Pettenkofer & Voit's diet for labourers (at rest) . .	137	72	352 =	19·5	283	= 2674·5
"Hard labour" Munich Prison diet	104	38	521 =	14·8	311·2	= 2915·9
A "liberal hard-worker's" diet (Stewart) . .	140	100	350 =	20	300	= 2939·0
A German soldier's diet, in the field .	151	46	522 =	21	340	= 3215·0
Pettenkofer & Voit's diet for labourers (at work) . .	137	173	352 =	19·5	386	= 3613·8

* Probably tea, bread and fat bacon.

Grammes of	Proteids.	Fat.	Carbo-hydrates.	Nitro-gen.	Carbon.	Calories.
A light, "infirm, non-working" Pauper's diet, consisting of No. 2 diet (above) with beef tea (estimated at 0), and ½ pint sweet milk, for buttermilk . .	70·8	25·1	329	= 12·3	201·6	= 1872·5

I shall postpone the discussion of the merits and values of the diets until I have placed before you (1) my estimation of the amount of *iron* in diets No. 1 and No. 2; and (2) the notes and tables of the observations made upon a large number of paupers living on those diets, for considerable, and sometimes long periods of time.

ANALYSES TO DETERMINE THE AMOUNT OF IRON IN DIETS NO. 1 AND NO. 2.*

Two Winchester quart bottles having been carefully cleansed with dilute sulphuric acid and distilled water, and repeatedly thereafter with distilled water, were used to transfer the fluid portions of the diets from Craigleith Poorhouse to the University Public Health Laboratory. The porridge, broth and bread were taken in their bowls straight from the dining table.

The fluid portions of the diets were slowly evaporated over a steam bath to the consistency of a syrup, then they were added to the respective solids of the diets. Two large porcelain dishes were used to contain the diets, viz :—

Diet No. 1—

Two bowls of porridge = 8 oz. oatmeal.
1½ pints buttermilk (evaporated down).
One bowl of broth.
8 oz. of bread.

Diet No. 2—

One bowl of porridge = 4 oz. oatmeal.
¾ pint buttermilk (evaporated down).
One bowl of broth.
12 oz. of bread.
One bowl (½ pint) of tea, with sugar and milk (evaporated down).

* It seems needless to say that all the agents used in the Analyses were tested and proved to be free from iron.

The two dishes, which previously had been carefully cleansed in the same manner as the Winchester quarts, and containing the whole of the respective diets, were placed upon water-baths, and strong sulphuric acid (1 in 4) guaranteed *iron free*, was added to the contents from time to time to char them. The evaporation was conducted very slowly, to prevent loss by spurting—this part of the process extending to about ten days. The resulting pitch-like masses were then carefully dried, and small pieces broken off and burnt in crucibles—the greatest care being taken to preserve the ash. This part of the process was very tedious—repeated firing of the ash being necessary to get rid of the organic matter.

The ash was then treated with a mixture of equal parts of sulphuric acid (1 in 4), and hydrochloric acid; and after ten minutes of gentle heat and stirring, the fluid was filtered through guaranteed iron free filter paper. The filtrate was preserved while the ash—now much reduced in quantity—was finally dried, and again burned, and again afterwards subjected to the action of the acids, and the solution added to the first filtrate.

The filter paper was also charred, and along with the crucibles used, washed with the acids, and the solutions added to the original filtrate.

Both diets were treated in the same way, and the resulting filtrates were now placed in evaporating dishes, and for a few hours heated to expel the hydrochloric acid. When all traces of chlorine were gone, I proceeded to get rid of traces of organic matter with permanganate of potash by adding it while heating the filtrates. As an excess of sulphuric acid had been used I again replaced the filtrates in the evaporating dishes, and evaporated off a portion of it. Again the filtrate was treated with permanganate of potash until a permanent pink colour was obtained. The filtrates were then treated with zinc (iron free) for four hours to reduce the iron from a ferric to a ferrous salt—the solution being then colourless.

A standardised solution of permanganate of potash (1 *c.c.* = 1 mgr. of iron) was used to convert the ferrous salt back to its ferric state. I found that a permanent pink was produced in No. 1 diet, by 9 *c.c.* of permanganate, and that 5 *c.c.* were sufficient to produce the same result in No. 2 diet.

The result is, therefore, that in No. 1 pauper's diet we get 9 milligrammes of iron; while in No. 2 diet we get only 5 milligrammes. It is satisfactory to note that this result is very near indeed to the figures one would expect. It compares

well with the results of some recent analyses of food stuffs, when the ingredients of the two diets are compared with the same ingredients in these analyses. Relatively also, when we remember that in diet No. 1 we have 4 ounces more of oatmeal, to set against 4 ounces of bread and a half pint of tea, the figures 9 : 5 are approximately correct, and, therefore, the analysis of the one diet is a check upon the other.

The analyses were conducted in the University Public Health Laboratory, and occupied a period of about six weeks.

I have to thank Dr Hunter Stewart and Dr Stockman for their kind supervision, both being present at the critical time, when the estimation of the amount of iron was made.

The anæmic condition of the paupers is best considered after the observations made upon the inmates of the Poorhouse, when the amount of iron in the diets will be also discussed.

OBSERVATIONS MADE UPON THE INMATES OF CRAIGLEITH POORHOUSE, EDINBURGH.

The following pages, 18-66, contain the notes of the observations made upon the inmates of Craigleith Poorhouse during 1895-96. As stated in the introductory remarks (page 3) the objects were to ascertain the amount of urine and urea excreted by the kidneys over periods of one month, and to examine the blood at intervals over as long a period as found practicable. A chart has been prepared, and placed opposite each name, giving a summary of each case to render the study of the figures less tedious. The strict rules of the Poorhouse make it almost impossible that the inmates could receive any food other than the diet alloted to each, and as many of those under observation acted as warders, &c., in the hospital, they were watched carefully by the nurses, in whom I can place trust. In many cases the inmates themselves were intelligent, and took interest in the investigation, and appeared anxious to carry out their instructions carefully and faithfully.

The inmates were first examined for organic disease, and only "healthy" paupers were selected. The urines were tested for sugar and albumin, and no case of diabetes nor Bright's disease, or even a suspicion of such, was included in the whole series of observations.

The urines of those selected were examined for albumin and sugar regularly throughout the whole period, and no trace of either was ever detected.

The name, age, occupation, height and weight were then recorded. The weights given include clothing, which in the case of males = 7 lbs., and females = 10 lbs. These figures must, therefore, be deducted from the weights recorded if the exact weight of the body is required. The inmates were weighed in the same clothing at the end as at the beginning of the month. The length of time in the poorhouse previous to beginning the observations, and his diet during that time; the history of the *frequency* of micturition at night, before and after becoming an inmate; general appearance, &c., were also noted. He was then supplied with a vessel in which to collect the whole day's urine and instructed to empty the bladder before an evacuation of the bowels, that no urine might be lost. After estimation of the quantity, an average sample was tested for the amount of urea by the hypobromite method.

It would not have been practicable, in the examination of something like 1200 "urines," to have adopted Kjeldahl's method, and estimated the total amount of nitrogen in the urine. For obvious practical reasons, also, the nitrogen in the fæces could not be estimated. A reference to the chart will show, however, that 8 per cent. of the total nitrogen excreted in the urine has been allowed for nitrogen not estimated by the hypobromite method; and that 10 per cent. of the nitrogen taken in the food has been added for the nitrogen lost in the fæces. There is a difference of opinion as to these figures, especially as to the amount of nitrogen in the fæces. Some consider 6 to 8 per cent. to be nearer the truth; others place the percentage much higher. On carefully comparing Von Noorden, Camerer, and others, I have decided to take 10 per cent. in the fæces as the best approximate average.

At the conclusion of each case the weight was again taken, and the results of a month recorded in the chart. The blood was examined as often thereafter as the pauper's residence in the poorhouse allowed.

GROUP I.

8 Cases on No 1 diet (no beef); and
2 Cases on No. 1 diet, *with* beef.

Value of No. 1 diet.

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.		Calories.
Grammes	83·5	17·3	333·8	=	14·8	194·2	=	1871·6

Value of No. 1 diet + beef.

,,	101·3	48·2	333·8	=	17·6	226	=	2232·0

CASE I.

Archibald B. Age 36. Height 5 ft. 7 in. Weight 9 st. 1 lb. Was in Glasgow Poorhouse for some time before coming here; now an inmate at Craigleith for one month, on No. 1 diet; organs healthy; slightly anæmic looking; requires to rise at night three or four times, formerly slept night through without micturition being necessary. He was formerly a postman, discharged for intemperance.

Diet No. 1 continued.—Doing no Work.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	120	1015	480	17	100	1017	500
2	120	1020	660	18	100	1018	550
3	100	1020	550	19	95	1017	523
4	100	1023	700	20	100	1014	425
5	100	1022	600	21	100	1015	500
6	110	1025	775	22	100	1015	550
7	100	1020	700	23	100	1014	525
8	105	1020	630	24	110	1014	660
9	100	1018	550	25	100	1015	450
10	110	1025	750	26	105	1015	582
11	100	1015	700	27	100	1017	600
12	90	1025	653	28	100	1020	750
13	95	1016	640	29	100	1020	750
14	100	1010	600	30	100	1017	750
15	110	1010	500	31	100	1014	650
16	105	1015	735				

Weight 8 st. 11 lbs. = loss of 4 lbs.

DIET No. 1 (no beef) = 14·8 grammes Nitrogen daily :
total in 31 days = ... 458·8 grammes.

Total **UREA** excreted in 31 days = 18,988 grains = 1230 grammes = of Nitrogen	573 grammes ;		
to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . .	(say) 46 ,,		
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . .	(say) 45 ,,	664	Total grammes Nitrogen excreted.
The difference =		205·2	grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 6,156 grammes (*i.e.*, about 13½ lbs.) loss.

Red blood corpuscles in c. mm. ; and percentage of Hæmoglobin.

1ST DAY.	24TH DAY.	31ST DAY.
4,400,000 : 75%	4,800,000 : 75%	4,800,000 : 75%

It may be pointed out here, that the nitrogen excreted is in great excess of the nitrogen taken—the loss being equivalent to nearly a *stone* of flesh. The body-weight only shows, however, a loss of 4 lbs.

See Chart for Urine and Urea lines.

CASE II.

T. K. (male). Age 25. Height 5 ft. 2 in. Weight 9 st. An inmate for three weeks on No. 1 diet ; has to rise occasionally at night—not regularly, he states ; looks somewhat pale ; does not work, and sits in a room which is very often overheated by steam pipes.

DIET No. 1.—DOING NO WORK.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	95	1012	432	13	90	1020	450
2	100	1010	300	14	90	1020	450
3	85	1020	425	15	100	1015	350
4	80	1012	320	16	100	1023	700
5	90	1015	405	17	100	1020	625
6	85	1020	382	18	100	1020	700
7	90	1015	360	19	100	1020	650
8	90	1020	450	20	100	1022	650
9	95	1023	570	21	100	1020	600
10	80	1020	600	22	100	1021	550
11	80	1021	480	23	100	1020	600
12	85	1020	515	24	100	1018	500

Weight now 8 st. 13¾ lbs. = loss of ¼ lb.
Would not complete the month.

DIET No. 1 (no beef) = 14·8 grammes Nitrogen daily :
total in 24 days = ... 355·2 grammes.

Total **UREA** excreted in 24 days = 12,064 grains = 781 grammes = of Nitrogen 364 grammes;
to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 29 ,,
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 35 ,,
428 { Total grammes Nitrogen excreted.

The difference = 72·8 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 2,184 grammes (*i.e.*, about 4¾ lbs.) loss in 3 weeks = to about 6½ lbs. loss in 1 month.

Red blood corpuscles in c. mm. ; and percentage of Hæmoglobin.

1ST DAY.	24TH DAY.
4,400,000 : 60%	4,800,000 : 75%

See Chart for Urine and Urea lines.

CASE III.

JOHN S. Age 50. Height 5 ft. 3 in. Weight 9 st. 8 lbs. Painter. An inmate for six weeks on No. 1 diet ; requires to rise at night, three or four times to micturite, and did not do so previous to coming to the Poorhouse.

DIET No. 1 CONTINUED.—DOING NO WORK.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	60	1015	360	9	100	1015	300
2	75	1016	300	10	90	1016	360
3	70	1017	350	11	100	1015	450
4	65	1015	325	12	100	1014	450
5	80	1012	360	13	100	1013	300
6	75	1016	423	14	95	1007	188
7	80	1017	440	15	100	1010	350
8	80	1012	340				

Weight now 9 st. 6½ lbs. = a loss of 1½ lbs.

Would not complete the month. The probability is that this man, being unaccustomed to porridge and buttermilk, did not at first consume all of his breakfast and supper. Gradually becoming accustomed to the diet, he completed his meals after a week. The urine and urea are seen to gradually rise. On the fourteenth day he was sick, hence the fall of urea.

DIET No. 1 (no beef) = 14·8 grammes Nitrogen daily: total in 15 days = ... 222 grammes.

Total **UREA** excreted in 15 days = 5,296 grains = 343 grammes = of Nitrogen 160 grammes;
to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 13 ,,
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 22 ,,
} 195 { Total grammes Nitrogen excreted.

The difference = 27 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 810 grammes (*i.e.*, about $1\frac{3}{4}$ lbs.) gain.

See Chart for Urine and Urea lines.

CASE IV.

W. W. (male). Age 50. Height 5 ft. 7 in. Weight 10 st. 7 lbs. Valet. In army 21 years. Organs healthy: an inmate for 9 weeks upon No. 1 diet; subject to fits of "ague" contracted abroad; only does "light jobs"—practically no work; began to rise at night only on coming to Poorhouse.

DIET No. 1 CONTINUED.—DOING NO WORK.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	100	1018	500	17	100	1020	550
2	110	1020	715	18	100	1021	525
3	100	1020	600	19	105	1015	578
4	110	1022	715	20	100	1013	500
5	110	1015	495	21	100	1012	500
6	100	1015	500	*22	90	1027	810
7	100	1010	525	23	85	1020	722
8	90	1020	653	24	100	1020	700
9	100	1015	575	25	85	1020	638
10	100	1017	650	26	100	1020	675
11	110	1015	495	27	100	1017	600
12	100	1016	400	28	90	1017	540
13	90	1017	450	29	100	1017	450
14	95	1020	475	30	100	1016	425
15	100	1016	475	31	105	1015	420
16	110	1018	495				

Weight 10 st. 2 lbs. = loss of 5 lbs.

* On this day this man had a short attack of "ague" with sickness, going through perfectly marked stages of cold, heat, and sweating. A few extras (sweet milk and beef tea) were ordered for the day. The blood was examined (see 22nd day). He continued next day as usual on diet No. 1 as before.

The few extras ordered on the day of the "ague" attack, does not materially affect the nitrogen taken.

DIET NO. 1 (no beef) = 14·8 grammes Nitrogen daily :
total in 31 days = ... 458·8 grammes.

Total **UREA** excreted in 31 days = 17,351 grains = 1,124 grammes = of Nitrogen 524 grammes ; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 42 „ and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 45 „	611	Total grammes Nitrogen excreted.	
The difference =	152·2	grammes,	

which multiplied by 30 gives the equivalent in **FLESH**, 4,566 grammes (*i.e.*, about 10 lbs.) loss.

Red blood corpuscles in c. mm. ; and percentage of Hæmoglobin.

1ST DAY.	22ND DAY.	32ND DAY.	87TH DAY.
5,200,000 : 100%	4,400,000 : 70%	4,800,000 : 75%	4,000,000 : 60%

See Chart for Urine and Urea lines.

CASE V.

P. C. (male). Age 34. Height 5 ft. 6 in. Weight 10st. 7½ lbs. An inmate for 8 months on No. 1 diet. House painter. Has to rise frequently every night to micturite : did not do so outside.

DIET STILL NO. 1.—NO WORK.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	75	1015	450	17	110	1020	633
2	70	1017	455	18	100	1015	375
3	75	1022	488	19	100	1015	450
4	100	1017	350	20	100	1014	450
5	100	1013	325	21	100	1015	425
6	90	1019	540	22	100	1017	600
7	85	1017	637	23	100	1015	450
8	100	1012	400	24	100	1015	425
9	95	1020	665	25	100	1018	525
10	100	1022	600	26	90	1020	563
11	100	1020	600	27	100	1015	450
12	95	1018	665	28	100	1012	450
13	100	1015	375	29	120	1012	510
14	100	1015	450	30	100	1012	325
15	80	1015	320	31	120	1012	480
16	100	1013	450				

Weight now 10 st. 6¼ lbs. = loss of 1¼ lbs.

DIET No. 1 = 14·8 grammes Nitrogen daily: total in 31 days = ... 458·8 grammes.

Total **UREA** excreted in 31 days = 14,881 grains = 899 grammes = of Nitrogen 414 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 33 ,,			
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 45 ,,		492	Total grammes Nitrogen excreted.
	The difference =	33·2	grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 996 grammes (*i.e.*, about 2 lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	31ST DAY.	52ND DAY.
4,400,000 : 60%	4,000,000 : 65%	4,000,000 : 60%

The loss, in this case, of body-weight corresponds very fairly with the loss of "flesh" indicated by the nitrogen excreted. The body-weight is a fair one.

See Chart for Urine and Urea lines.

CASE VI.

J. M. (male). Age 47. Height 5 ft. 7 in. Weight 10 st. 10 lbs. Newly admitted: requires to rise at night to micturite, very frequently; did not do so before coming to the Poorhouse.

DIET No. 1.—DOING NO WORK.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	80	1012	360	12	140	1015	630
2	80	1013	400	13	140	1020	840
3	80	1015	560	14	130	1018	585
4	100	1015	500	15	140	1015	490
5	100	1012	450	16	140	1015	630
6	150	1015	600	17	130	1018	585
7	200	1015	1000	18	140	1016	630
8	160	1012	720	19	140	1017	770
9	180	1012	720	20	130	1017	520
10	175	1013	700	21	120	1018	510
11	160	1018	800	22	110	1015	605

Weight now 10 st. 7½ lbs. = loss of 2½ lbs.

DIET No. 1 = 14·8 grammes Nitrogen daily : total in 22 days = ... 325·6 grammes.

Total **UREA** excreted in 22 days = 13,605 grains = 881 grammes = of Nitrogen 411 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 33 „

and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 32 „

476 { Total grammes Nitrogen excreted.

The difference = 150·4 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 4,512 grammes (*i.e.*, about 10 lbs.) loss.

Red blood corpuscles in c.mm. ; and percentage of Hæmoglobin.

1ST DAY.
4,800,000 : 65%

See Chart for Urine and Urea lines.

CASE VII.

A. W. (male). Age 66. Height 5 ft. 10 in. Weight 10 st. 11 lbs. An inmate for seven weeks on No. 1 diet. A very alcoholic case ; cabman ; requires to rise at night very frequently ; sits all day in the "hair teazing" house.

DIET No. 1.—DOING NO WORK.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	120	1010	420	16	130	1015	455
2	115	1012	460	17	130	1015	455
3	110	1010	440	18	150	1014	488
4	126	1016	660	19	135	1020	810
5	126	1010	567	20	130	1015	390
6	120	1012	360	21	130	1015	390
7	125	1014	532	22	130	1015	390
8	120	1015	450	23	120	1016	520
9	120	1012	450	24	120	1017	720
10	120	1015	480	25	120	1020	780
11	125	1015	470	26	130	1018	715
12	135	1015	540	27	120	1017	780
13	130	1014	552	28	110	1015	550
14	125	1014	563	29	115	1013	517
15	120	1015	450	30	120	1020	960

Weight now 10st. 9 lbs. = a loss of 2 lbs.

This man drinks large quantities of water.

DIET No. 1 (no beef) = 14·8 grammes Nitrogen daily: total in 30 days = ... 440 grammes.

Total **UREA** excreted in 30 days = 15,314 grains = 992 grammes = of Nitrogen 462 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 37 „
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 44 „
543 { Total grammes Nitrogen excreted.

The difference = 103 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 3,090 grammes (*i.e.*, about 6½ lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	27TH DAY.	52ND DAY.
4,800,000 : 65%	4,400,000 : 70%	3,800,000 : 50%

See Chart for Urine and Urea lines.

CASE VIII.

D. L. (male). Age 66. Height 5 ft. 10 in. Weight 11 st. 5¾ lbs. An inmate 6 weeks on No. 1 diet. Clerk; requires to rise frequently at night to micturite; did not do so previous to coming to the Poorhouse.

DIET No 1.—DOING NO WORK.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	75	1016	282	16	100	1012	300
2	75	1015	300	17	90	1014	405
3	80	1012	340	18	100	1012	350
4	90	1012	315	19	90	1014	382
5	95	1020	520	20	100	1016	500
6	90	1015	395	21	90	1015	405
7	100	1013	400	22	100	1012	350
8	95	1014	428	23	100	1013	550
9	100	1015	400	24	95	1015	428
10	100	1014	400	25	108	1017	648
11	100	1015	350	26	110	1020	715
12	100	1015	375	27	108	1015	432
13	98	1015	441	28	110	1010	330
14	105	1012	368	29	108	1012	351
15	90	1012	315				

Weight now 11 st. 8¾ lbs. = a gain of 3 lbs.

DIET No. 1 = 14·8 grammes Nitrogen daily : total in 29 days = ... 429·2 grammes.

Total **UREA** excreted in 29 days = 11,775 grains = 763 grammes = of Nitrogen 356 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 28 ,,
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say 42 ,, } 426 { Total grammes Nitrogen excreted.

The difference = 3·2 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 96 grammes (*i.e.*, about 3 ounces) gain.

Red blood corpuscles in c. mm. ; and percentage of Hæmoglobin.

1ST DAY.	52ND DAY.
4,400,000 : 75%	4,800,000 70%

See Chart for Urine and Urea lines.

CASE IX.

J. M. (male). Age 50. Height 5 ft. 4½ in. Weight 9 st. 5 lbs. Indiarubber worker. An inmate for 3½ months on No. 1 diet + beef, working in the stick-house bunching firewood. This is deemed the hardest work in the Poorhouse. It requires repeated and strong muscular efforts to compress the bundles by means of a lever and chain.

DIET No. 1 + BEEF.—CONTINUED THE HARD WORK.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	70	1020	385	12	55	1025	412
2	80	1020	400	13	60	1024	420
3	70	1013	332	14	60	1018	390
4	75	1015	430	15	65	1020	390
5	65	1020	455	16	60	1022	375
6	70	1019	525	17	65	1020	455
7	65	1020	520	18	50	1015	300
8	68	1015	272	19	50	1020	300
9	60	1020	420	20	70	1018	350
10	65	1020	422	21	100	1015	625
11	65	1018	488				

Weight now 9 st. 6 lbs. = gain of 1 lb.

DIET No. 1. (with beef) = 17·6 grammes Nitrogen daily: total in 21 days = ... 369·6 grammes.

Total **UREA** excreted in 21 days = 8,666 grains = 561 grammes = of Nitrogen	261 grammes;		
to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . .	(say) 21 „		
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . .	(say) 36 „	318	Total grammes Nitrogen excreted.
	The difference =	51·6	grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 1,548 grammes (*i.e.*, about 3½ lbs.) gain.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	52ND DAY.
4,800,000 : 65%	4,800,000 : 65%

See Chart for Urine and Urea lines.

CASE X.

J. B. (male). Age 58. Height 5 ft. 6 in. Weight 9 st. 13 lbs. Butcher. An inmate for seven months—the first three months on plain No. 1 diet, the last four months on No. 1 and beef. Works as butcher here. Never had to rise at night to micturite, before coming to the Poorhouse; has now to do so three or four times. His usual diet when outside was tea and bread, morning and evening. Dinner: broth, beef and bread. Diet now No. 1 + beef.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	110	1010	495	16	105	1015	472
2	100	1012	475	17	100	1016	600
3	100	1010	450	18	110	1014	495
4	100	1011	475	19	105	1015	472
5	105	1010	577	20	100	1016	425
6	105	1012	525	21	110	1017	660
7	105	1015	630	22	100	1015	700
8	105	1016	577	23	105	1015	578
9	105	1017	600	24	105	1016	552
10	100	1015	550	25	105	1015	572
11	100	1015	550	26	105	1015	525
12	100	1014	475	27	105	1015	525
13	100	1015	525	28	105	1015	446
14	105	1015	475	29	100	1014	450
15	100	1016	450	30	100	1014	400

Weight now 9 st. 10 lbs. = 3 lbs. loss.

DIET No. 1 (with beef) = 17·6 grammes Nitrogen daily: total in 30 days = ... 528 grammes.

Total **UREA** excreted in 30 days = 15,701 grains = 1,017 grammes = of Nitrogen 474 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method. . (say) 38 „
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 52 „

564 { Total grammes Nitrogen excreted.

The difference = 36 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 1,080 grammes (*i.e.*, about 2½ lbs.) loss.

Red blood corpuscles in c. mm.; and precentage of Hæmoglobin.

1ST DAY.	30TH DAY.	60TH DAY.	90TH DAY.
4,000,000 : 60%	4,000,000 : 60%	5,000,000 : 60%	4,400,000 : 60%

The nitrogen excreted in excess, corresponds very nearly with the loss in the body-weight. The addition of beef to the diet, not only slightly increases the nitrogen taken, but gives also 30 grammes more of fat. In this case the loss of nitrogen is much less than in the former cases on No. 1 diet alone (no beef).

See Chart for Urine and Urea lines.

GROUP II.

10 males on No. 2 diet, *with* beef; and
5 females on No. 2 diet, *with* beef.

Value of No. 2 diet + beef.

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.		Calories.
Grammes	87·5	44·8	324·5	=	15	217·7	=	2105·7

CASE XI.

W. M'C. (male). Age 62. Height 5 ft. 7 in. Weight 8 st. 5¾ lbs. Gasfitter. An inmate for six weeks on No. 1 diet; increased micturition complained of; poor looking and thin.

DIET No. 2 + BEEF.—
LIGHT WORK AS A "POORHOUSE" WARDER.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	80	1017	280	13	80	1017	520
2	90	1025	360	14	75	1020	498
3	85	1020	340	15	90	1015	450
4	80	1025	680	16	100	1010	450
5	75	1020	575	17	80	1015	560
6	70	1020	700	18	70	1020	544
7	90	1023	765	19	100	1020	750
8	100	1020	600	20	100	1018	675
9	68	1025	612	21	100	1015	650
10	80	1018	520	22	80	1025	540
11	80	1015	520	23	80	1022	480
12	75	1020	525				

This Case left abruptly without any warning, hence absence of weight, &c.

DIET No. 2 + beef = 15 grammes Nitrogen daily:
total in 23 days = ... 345 grammes.

Total **UREA** excreted in 23 days = 12,594 grains = 809 grammes = of Nitrogen 377 grammes;
to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 30 „
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 34 „
= 441 (Total grammes Nitrogen excreted.)

The difference = 96 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 2,880 grammes (*i.e.*, about 6¼ lbs.) loss, which, had the month been completed, = 8½ lbs. of loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	10th Day.
4,400,000 : 60%	4,800,000 : 60%

See Chart for Urine and Urea lines.

CASE XII.

Alexander H. Age 45. Height 5 ft. 6 in. Weight 8 st. 10¼ lbs. Coachman. A non-working inmate of Poorhouse, for 14 weeks on No. 1 diet; required to rise three times at night to micturite; now doing light work in Poorhouse as a warder.

Diet No. 2 + Beef.—Working as a Warder.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	60	1015	345	17	80	1017	520
2	50	1018	400	18	80	1015	500
3	60	1020	450	19	85	1020	637
4	60	1013	420	20	80	1021	560
5	60	1020	405	21	85	1020	595
6	70	1020	472	22	80	1020	560
7	70	1020	472	23	85	1021	595
8	75	1018	450	24	80	1020	640
9	70	1020	420	25	75	1022	788
10	80	1017	540	26	75	1020	600
11	70	1016	455	27	80	1020	560
12	65	1017	440	28	80	1015	520
13	70	1015	472	29	80	1015	440
14	85	1018	595	30	75	1017	455
15	90	1017	540	31	75	1020	512
16	90	1015	608				

Weight 8 st. 10 lb. = ¼ lb. of a loss.

Diet No. 2 with beef = 15 grammes Nitrogen daily: total in 31 days = ... 465 grammes.

Total **UREA** excreted in 31 days = 15,966 grains = 1034 grammes = of Nitrogen 482 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 38 ,, and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 46 ,, = 566 grammes Nitrogen excreted.

The difference = 101 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 3,030 grammes (*i.e.*, about 6½ lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	31st Day.	93rd Day.
4,600,000 : 55%	4,800,000 : 70%	4,800,000 : 70%

See Chart for Urine and Urea lines.

CASE XIII.

E. G. (male). Age 66. Height 5 ft. 7½ in. Weight 8 st. 11 lbs. An inmate of Poorhouse fifteen months, and during last twelve months has been on No. 2 + Beef. A maltman by trade; has to rise frequently at night to micturite; did not do so, as a rule, when outside.

Diet No. 2 + Beef.—Working as a Warder in Poorhouse.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	70	1017	385	15	60	1015	420
2	75	1015	412	16	60	1016	510
3	60	1017	315	17	65	1015	455
4	60	1016	330	18	65	1020	487
5	56	1018	350	19	60	1020	435
6	60	1020	450	20	65	1015	325
7	55	1017	330	21	60	1015	300
8	55	1020	412	22	60	1020	450
9	60	1015	300	23	60	1022	480
10	65	1015	342	24	65	1020	488
11	75	1015	525	25	65	1020	470
12	60	1015	315	26	65	1020	428
13	60	1016	360	27	60	1020	420
14	65	1015	395	28	65	1020	488

Weight now 8 st. 10 lbs. = loss of 1 lb.

In this case there has been nothing abnormal. The amount of urine and urea excreted has been normal and there has been no disturbance of the nitrogenous equilibrium. The body-weight practically agrees with the record of nitrogen income and expenditure. The work of a Warder in the Poorhouse is much lighter than that of a Warder in the Hospital.

DIET No. 2 + beef = 15 grammes Nitrogen daily: total in 28 days = ... 420 grammes.

Total **UREA** excreted in 28 days = 11,377 grains = 737 grammes = of Nitrogen 343 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 27 ,,
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 42 ,, } 412 { Total grammes Nitrogen excreted.

The difference = 8 grammes.

which multiplied by 30 gives the equivalent in **FLESH**, 240 grammes (*i.e.*, about ½ lb.) gain.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	19TH DAY.	50TH DAY.	80TH DAY.
4,800,000 : 65%	4,000,000 : 70%	4,800,000 : 60%	4,400,000 : 70%

See Chart for Urine and Urea lines.

CASE XIV.

P. G. (male). Age 51. Height 5 ft. 8 in. Weight 9 st. 1¼ lbs. Labourer. An inmate for nine months, chiefly on No. 2 diet + beef; did not require to rise at night when outside, or only very seldom; now requires to rise three or four times. Works in the kitchen, which is fairly hard work, filling boilers, carrying heavy cans, &c.

DIET No. 2 + BEEF.—WORKING IN KITCHEN, CARRYING FOOD, &c.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	120	1012	600	16	110	1016	467
2	110	1015	550	17	105	1015	472
3	115	1013	518	18	110	1015	467
4	120	1015	570	19	115	1017	518
5	120	1012	480	20	115	1012	518
6	115	1015	546	21	120	1016	720
7	120	1015	660	22	120	1015	660
8	115	1010	575	23	120	1015	600
9	120	1012	570	24	120	1015	570
10	120	1014	510	25	115	1017	632
11	120	1015	600	26	115	1015	545
12	120	1014	720	27	120	1015	570
13	120	1015	770	28	115	1015	575
14	120	1015	480	29	115	1014	518
15	115	1016	460	30	120	1014	510

Weight now 8 st. 13½ lbs. = 1¾ lbs. loss.

The increased excretion of urea, in this case, was most

probably due to the hard work of the "kitchen" warders, causing him to drink much water (which he acknowledged). The water in the diet = 75 ounces.

Diet No 2. + beef = 15 grammes Nitrogen daily: total in 30 days = ... 450 grammes.

Total **UREA** excreted in 30 days = 16,951 grains = 1098 grammes = of Nitrogen 512 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . .	(say)	41 „	598 Total grammes Nitrogen excreted.
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . .	(say)	45 „	

The difference = 148 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 4,440 grammes (*i.e.*, about 9 lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	16th Day after.	60th Day.	90th Day.
4,400,000 : 55%	3,600,000 : 55%	5,200,000 : 65%	4,000,000 : 60%

See Chart for Urine and Urea lines.

CASE XV.

John W. Age 62. Height 5 ft. 7 in. Weight 9 st. 2 lbs. Engineer. Organs healthy; looks anæmic; has been an inmate, off and on, for the last six years; acts as a hospital warder. Diet has always been No. 2 + beef. Slight increase in micturition, occasionally requires to rise at night since coming to Poorhouse.

Diet No. 2 + Beef.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	50	1018	250	14	60	1016	330
2	56	1015	280	15	70	1016	350
3	48	1015	240	16	70	1014	385
4	64	1017	416	17	80	1016	480
5	60	1015	420	18	80	1016	520
6	80	1015	400	19	75	1017	488
7	80	1013	460	20	80	1015	480
8	50	1015	225	21	80	1015	480
9	60	1018	360	22	75	1016	470
10	50	1012	338	23	80	1015	480
11	60	1013	270	24	90	1014	518
12	70	1015	332	25	80	1015	480
13	65	1015	325	26	80	1015	500

Weight 9 st. 10¼ lbs. = gain of 8¼ lbs.

DIET No. 2 + beef = 15 grammes Nitrogen daily : total in 26 days = ... 390 grammes.

Total **UREA** excreted in 26 days = 10,277 grains = 665 grammes = of Nitrogen 305 grammes ; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 24 „
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . . (say) 39 „

368 (Total grammes Nitrogen excreted.)

The difference = 22 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 660 grammes (*i.e.*, about 1½ lbs.) gain.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	21ST DAY.	86TH DAY.	116TH DAY.
4,400,000 : 55%	4,600,000 : 65%	4,800,000 : 60%	4,800,000 : 60%

See Chart for Urine and Urea lines.

CASE XVI.

R. M. (male). Age 34. Height 5 ft. 8 in. Weight 9 st. 11½ lbs. Law-clerk. An inmate for a week on No. 1 diet ; came in " destitute and broken down " ; *no* increased micturition at night.

DIET No. 2. + BEEF.—WORKING AS A WARDER.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	60	1025	495	16	65	1020	650
2	70	1022	560	17	60	1022	570
3	70	1022	560	18	60	1020	480
4	60	1023	510	19	65	1020	520
5	70	1022	560	20	60	1020	480
6	75	1025	675	21	65	1025	503
7	60	1020	480	22	70	1022	518
8	66	1020	545	23	70	1022	518
9	60	1021	480	24	70	1025	595
10	60	1025	600	25	70	1027	560
11	55	1020	302	26	70	1024	525
12	50	1028	500	27	60	1025	510
13	50	1022	350	28	60	1025	480
14	65	1020	536	29	75	1020	562
15	65	1020	486	30	70	1018	525

Weight now 9 st. 10 lbs. = 1½ lbs. of a loss.

DIET No. 2 with beef = 15 grammes Nitrogen daily: total in 30 days = ... 450 grammes.

Total **UREA** excreted in 30 days = 15,715 grains = 1018 grammes = of Nitrogen, 475 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . (say) 38 „
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 45 „

558 { Total grammes Nitrogen excreted.

The difference = 108 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 3,240 grammes (*i.e.*, about 7 lbs.) loss.

Red blood corpuscles in c. m.m.; and percentage of Hæmoglobin.

1ST DAY.	30TH DAY.	90TH DAY.
4,000,000 : 65%	4,600,000 : 70%	4,800,000 : 75%

REMARK.—This man worked hard as a Warder in the Hospital.

See Chart for Urine and Urea lines.

CASE XVII.

JOHN M. Age 54. Height 5 ft. 5½ in. Weight 10 st. 6 lbs. Tailor, and labourer last ten years. Organs healthy. An inmate of Poorhouse for a month on No. 1 diet. Increased micturition at first but not now.

DIET No. 2 + BEEF.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	60	1020	330	17	50	1023	475
2	70	1022	490	18	50	1025	500
3	70	1017	350	19	50	1022	450
4	70	1025	490	20	55	1025	518
5	70	1025	473	21	50	1022	400
6	50	1015	288	22	55	1025	468
7	40	1025	260	23	50	1030	575
8	65	1022	374	24	50	1025	488
9	60	1030	480	25	50	1023	400
10	60	1022	540	26	50	1025	400
11	60	1023	450	27	50	1023	400
12	65	1025	617	28	50	1025	475
13	40	1025	380	29	50	1022	438
14	50	1027	425	30	50	1025	450
15	55	1024	440	31	50	1025	438
16	60	1026	465				

Weight now 10 st. 3¾ lbs. = loss of 2¼ lbs.

DIET No. 2 with beef = 15 grammes Nitrogen daily: total in 31 days = ... 465 grammes.

Total **UREA** excreted in 31 days = 13,727 grains = 889 grammes = of Nitrogen 414 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 33 „

and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 46 „

493 { Total grammes Nitrogen excreted.

The difference = 28 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 840 grammes (*i.e.*, about $1\frac{14}{16}$ lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	23RD DAY.	31ST DAY.
4,800,000 : 95%	5,200,000 : 95%	5,200,000 : 80%

In this case there has been no polyuria nor excessive urea excretion. The nitrogenous equilibrium has very nearly been maintained, on No. 2 + beef; and the slight loss in body-weight corresponds very nearly with the loss of flesh indicated by the amount of nitrogen excreted. It will be noted, however, that this man is of fair body-weight.

See Chart for Urine and Urea lines.

CASE XVIII.

ALEXANDER D. Age 52. Height 5 ft. 8 in. Weight 10 st. 11 lbs. Formerly worked in a chemical work (5 years). Ten years in the army previously. Fairly healthy; subject to asthma, but now better. An inmate for three months on No. 2 + beef; requires to rise three times at night since coming to Poorhouse.

DIET No. 2 + BEEF.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	60	1022	510	9	50	1022	438
2	60	1023	480	10	56	1023	448
3	50	1022	375	11	50	1025	400
4	55	1023	468	12	60	1022	540
5	50	1023	400	13	55	1022	482
6	60	1020	420	14	55	1020	427
7	60	1020	510	15	50	1025	450
8	50	1025	475	16	55	1020	482

CONTINUED.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grain Urea.
17	55	1017	440	24	55	1022	467
18	60	1018	495	25	50	1020	425
19	50	1022	475	26	50	1020	400
20	50	1022	450	27	55	1020	467
21	50	1022	475	28	60	1020	480
22	55	1022	495	29	60	1020	450
23	55	1020	440				

Weight now 10 st. 12½ lbs. = gain of 1½ lbs.

DIET No. 2 with beef = 15 grammes Nitrogen daily:
total in 29 days = ... 435 grammes.

Total **UREA** excreted in 29 days = 13,264 grains = 859 grammes = of Nitrogen 400 grammes;
to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 32 „
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 43 „
= 475 grammes Nitrogen excreted.

The difference = 40 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 1,200 grammes (*i.e.*, about 2¾ lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	18TH DAY.	29TH DAY.	80TH DAY.
4,800,000 : 100%	5,200,000 : 90%	5,200,000 : 100%	5,200,000 : 75%

The urea excreted in this case is not abnormal as regards daily quantity. There is still a slight loss, however, of nitrogen over the month; but it will again be noted the body-weight is a fair one.

See Chart for Urine and Urea lines.

CASE XIX.

ARCHIBALD A. Age 53. Height 5 ft. 9 in. Weight 11 st. 2 lbs. Brass finisher. Organs healthy: came in with an ulcer of the leg (now healed); looks pasty-complexioned and anæmic; has been an inmate for three years, and during last year has been acting as a Warder on No. 2 + beef. Says he was always a pale-looking man. Requires to rise at night three times since coming to Poorhouse.

DIET No. 2 + BEEF.—ACTING AS WARDER AT THE GATE.

Days.	Oz. Urine.	Sp. Gr.	Grains. Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	50	1014	175	17	90	1012	405
2	45	1016	158	18	80	1013	400
3	40	1014	140	19	70	1015	350
4	40	1015	140	20	75	1015	412
5	50	1015	225	21	70	1016	402
6	40	1015	160	22	75	1016	428
7	70	1015	315	23	80	1015	460
8	70	1015	420	24	110	1013	468
9	50	1017	350	25	100	1014	425
10	40	1015	240	26	100	1015	400
11	90	1015	405	27	90	1012	360
12	80	1013	400	28	100	1010	475
13	80	1014	440	29	100	1010	450
14	90	1015	450	30	100	1012	475
15	90	1011	315	31	100	1012	500
16	80	1011	320				

Weight 10 st. $11\frac{3}{4}$ lbs. = loss of $4\frac{1}{4}$ lbs.

The amount of urine being low at the beginning of the observation may possibly be due to loss of water by the skin and lungs, as he is in a position where he may work harder than others, if he chooses, and he is known to be willing enough at times. The loss of body-weight has not been at the expense of the nitrogenous tissues, and suggests that it must have been from the using up of fat and carbo-hydrates. He is a large man of a pale and flabby appearance. The manner in which the amount of urine and urea excreted, rises towards the end of the observations, shews that the more the "watery" diet taken, is excreted by the kidneys, the higher is the amount of urea eliminated. It will be noticed that there is a very fair relation in the amount of urine voided, with the urea excreted, preserved throughout.*

DIET. No. 2 with beef = 15 grammes Nitrogen daily:
total in 31 days = ... 465 grammes.

Total **UREA** excreted in 31 days = 11,063 grains = 716 grammes = of Nitrogen 334 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 26 ,, and also add 10 per cent. Nitrogen, taken and lost in the fæces . . . (say) 46 ,, } 406 { Total grammes Nitrogen excreted.

The difference = 59 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 1770 grammes (*i.e.* about $3\frac{3}{4}$ lbs.) gain.

* The remarks on this page—except those which apply to the body-weight and appearance—may, in part, be applied to Case XII., page 30.

Red blood corpuscles in c. mm. ; and percentage of Hæmoglobin.

1st Day.	25th Day.	86th Day.	116th Day.
4,800,000 : 70%	4,400,000 : 65%	3,200,000 : 40%	4,800,000 : 65%

CASE XX.

John M'A. Age 55. Painter. A thin-looking man of 5 ft. 4 in. weighing 8 st. 11 lbs. Organs healthy ; looks decidedly anæmic ; an inmate for three weeks on No. 1 diet ; requires to rise at night occasionally, but did not do so when ontside the Poorhouse.

Diet now No. 2 + Beef ; works indifferently well, as a Warder in the Hospital. Diet No. 1 (without beef) on the 25th day.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	100	1010	475	17	70	1015	385
2	70	1018	525	18	50	1020	400
3	60	1020	480	19	60	1015	360
4	90	1018		20	60	1015	330
5	70	1020		21	70	1016	402
6	60	1015	450	22	70	1015	420
7	90	1012	472	23	80	1015	320
8	60	1015	480	24	70	1020	420
9	50	1020	350	*25	70	1020	438
10	60	1016	330	26	100	1018	525
11	60	1017	375	27	80	1015	440
12	70	1015	455	28	100	1020	550
13	80	1015	360	29	100	1020	500
14	60	1015	375	30	98	1020	490
15	60	1017	285	31	100	1018	500
16	70	1015	385				

Weight now 8 st $12\frac{1}{4}$ lbs. $= 1\frac{1}{4}$ lbs. gain.

Diet No. 2 with beef, to the 24th day (inclusive) = 15
1 (no beef) on 25th day to 31st (inclusive) = 14·8

grammes Nitrogen daily : total in $\frac{22}{7}$† days. . . 330 + 103·6 grms.

Total **UREA** excreted in $\frac{22}{7}$ days $= \frac{8834}{3443}$ grains =
$\frac{572}{223}$ grammes = of Nitrogen 266·4 + 104 grs.
to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 21 + 8 ,,
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 33 + 10 ,, } 320·4 + 122 { Total grammes Nitrogen excreted.

The difference = + 10·4 — 18·4 grms.,

* Diet No. 1 given on this day, to the end of the month.

† Only 22 days' urea can be counted, as the urea of the 4th and 5th days was (accidentally) not estimated. This case shews the increased excretion of urine and urea when the more "watery" diet is given. (See further remarks.)

which multiplied by 30 gives the equivalent in **FLESH**, $\frac{312}{552}$ grammes (*i.e.*, about $\frac{\frac{11}{16}\text{ lbs.) gain in 24 days.}}{1\frac{1}{4}\text{ lbs.) loss in 7 days.}}$

Red blood corpuscles in c. mm. ; and percentage of Hæmogoblin.

1st Day.	13th Day.	31st Day.
3,100,000 : 60%	3,600,000 : 70%	4,200,000 : 70%

See Chart for Urine and Urea Lines.

Notes on Case XX. (J. M'A., male).

This man was a warder in the Hospital on diet No. 2 + beef for twenty-four days. Referring to the table of diets, No. 2 + beef has the following value :—

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes .	87·5	44·8	324·5	=	15	217·7

He was found to be a very poor worker, and was dismissed on the morning of the twenty-fifth day as quite useless. His diet then became that of a non-worker, viz. :—No. 1 (without beef).

This diet has the following value :—

Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
83·5	17·3	333·8	=	14·8	194 2

It will be seen that during the twenty-four days he was on No. 2 + beef the balance of "income" and "output" was on his side—*i.e.*, he maintained his nitrogenous equilibrium, and kept about an average of 0·5 grammes nitrogen daily to restore his tissues—he doing practically little or no work during that time. During the last week of the month, while on diet No. 1, it will be observed that the "output" of nitrogen is considerably in excess of the "income." He now loses an average of about 2·6 grammes daily—the nitrogenous equilibrium being upset.

Comparing now the value of the two diets it will be noticed that the nitrogen *taken* remains practically the same, being only 0·2 grammes less daily ; also that the carbo-hydrates of the lower (non-working) diet are *increased* by 9·3 grammes.

The cause of the change, then, appears to be the reducing of the quantity of the fat by more than a half—27·5 grammes daily—preventing the conservation of the nitrogen in the organism ; or the increased diuresis produced by the extra

15 ounces of buttermilk in diet No. 1, combined with the effects of the *extra water* in this diet.

If the last week of this case be compared with others who have had the same diet (No. 1) with the addition of beef (say the case of J. B., Case X., page 27) it will be seen that J. M'A. during the last week lost in *flesh* at the rate of 1¼ lbs. *per week*, while J. B. only lost 2½ lbs. in the *month*. Most of the cases on No. 1 diet have lost at a greater rate than J. M'A. It may be argued, however, that J. B., being about a stone heavier in body-weight, had some reserve of fat upon which to draw, hence a slower "output" of nitrogen. J. M'A., having no reserve, begins at once to "feed upon his nitrogenous tissues."

Had the body-weight of J. M'A. been taken on the twenty-fourth day, I do not doubt but what the gain of 1¼ lbs. recorded at the *end* of the month, would have been found to be the result chiefly of the earlier diet; but as I explain elsewhere, so long as no record is kept of the fate of the C and H atoms of the food taken, it is impossible to balance the body-weight with the equivalent in *flesh* indicated by the nitrogen excreted or retained.

Second Division of Group II.—(Females).

CASE XXI.

Helen H. Age 51. Height 5 ft. Weight 6 st. 11 lbs. An inmate, and brought up, it may be said, in the Poorhouse; anæmic; works in Laundry. Always had No. 2 with Beef. Increased frequency of micturition only occasionally.

DIET No. 2 + BEEF.—"CLEANING WORK" AND LAUNDRY.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	90	1010	405	10	70	1015	350
2	100	1020	350	11	80	1015	400
3	50	1010	175	12	90	1015	405
4	70	1011	245	13	75	1017	392
5	40	1020	240	14	60	1015	240
6	50	1020	300	15	40	1015	240
7	60	1020	330	16	60	1015	300
8	80	1014	280	17	50	1015	375
9	100	1016	450	18	60	1016	360

CONTINUED.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
19	50	1020	300	25	60	1015	285
20	80	1015	280	26	65	1016	292
21	75	1016	375	27	70	1015	280
22	70	1015	245	28	70	1015	280
23	65	1015	260	29	65	1020	342
24	65	1014	292				

Weight now 6 st. 7½ lbs. = loss of 3½ lbs.

DIET No. 2 with beef = 15 grammes Nitrogen daily: total in 29 days = ... 435 grammes.

Total **UREA** excreted in 29 days = 9,068 grains = 587 grammes = of Nitrogen 273 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . (say) 22 ,, and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 43 ,, } 338 { Total grammes Nitrogen excreted.

The difference = 97 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 2,910 grammes (*i.e.*, about 6½ lbs.) gain.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	29TH DAY.
3,700,000 : 68%	3,600,000 : 65%

In this case, the loss has not been at the expense of the nitrogenous tissues, as the total results in the chart above show a considerable gain. There has sometimes been little urine passed, no doubt due to loss of water by the skin and lungs, as she is an active worker.

See Chart for Urine and Urea lines.

CASE XXII.

MARION R. Age 37. Height 5 ft. 2 in. Weight 7 st. 13 lbs. Laundry worker. Inmate for seven months on No. 2 + beef, requires to rise twice during the night, often only once, and sometimes not at all.

Diet No. 2 + Beef.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	70	1020	630	11	65	1015	358
2	60	1020	480	12	60	1015	330
3	50	1015	225	13	70	1014	332
4	30	1021	300	14	50	1010	150
5	40	1021	400	15	40	1020	270
6	60	1020	480	16	60	1012	315
7	70	1022	490	17	70	1013	350
8	60	1020	480	18	65	1012	309
9	70	1015	315	19	70	1016	350
10	60	1015	300	20	60	1015	270

Diet No 2. with beef = 15 grammes Nitrogen daily: total in 20 days = ... 300 grammes.

Total **UREA** excreted in 20 days = 7,134 grains = 462 grammes = of Nitrogen 215 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 17 „ and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 30 „ = 262 grammes (Total grammes Nitrogen excreted.)

The difference = 38 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 1,148 grammes (*i.e.*, about 2½ lb.) gain.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	35 Days later (on returning).
4,000,000 : 75%	4,400,000 : 70%

This case left without warning, and I was unable to examine the blood, nor take the body-weight. On her return a fortnight later, the weight was found to be 7 st. 12 lbs., *i.e.*, 1 lb. lighter than at the beginning of the observations. Over the twenty days the "output" of nitrogen has been less than the "intake." She works in the Laundry.

See Chart for Urine and Urea lines.

CASE XXIII.

Ann Q. Age 59. Height 5 ft. 3 in. Weight 8 st. 1 lb. Organs apparently healthy; looks *very* anæmic. The voice is hoarse and the bridge of nose has fallen in. An inmate for a fortnight on No. 2 + beef. Since entering Poorhouse has to rise thrice in the night.

Diet now No. 2 + Beef.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	120	1012	840	17	208	1012	780
2	152	1012	912	18	190	1010	712
3	190			19	180	1022	720
4	184			20	200	1012	700
5	180	1012	720	21	196	1010	686
6	170	1010	595	22	184	1010	644
7	160	1015	800	23	190		
8	156	1020	1170	24	184	1015	690
9	170	1010	722	25	204	1010	765
10	174	1017	783	26	200	1010	800
11	190	1012	665	27	184	1015	1196
12	180	1015	900	28	140	1015	560
13	170	1010	805	29	190	1015	760
14	194	1012	776	30	204	1015	918
15	206	1012	1030	31	190	1016	855
16	190	1013	950				

Weight 8 st. 3 lbs. = gain of 2 lbs.

Diet No. 2 with beef = 15 grammes Nitrogen daily: total in 28 * days = ... 420 grammes.

Total **UREA** excreted in 28 days = 22,454 grains = 1,455 grammes = of Nitrogen 678 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 54 „

and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 42 „

774 { Total grammes Nitrogen excreted.

The difference = 354 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 10,620 grammes (*i.e.*, about 23½ lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	15th Day.	32nd Day.
4,000,000 : 45%	4,400,000 : 40%	4,000,000 : 60%

The gain of body-weight is difficult to explain, in relation to the immense loss of nitrogen—a loss equivalent to about 1½ stones flesh. She asserts that she has no thirst, and only drinks water moderately. The evidences of old specific disease are marked enough, and suggest that waxy disease may be the cause of the abnormal conditions. She left the Poorhouse before any further observations could be made in the hospital.

See Chart for Urine and Urea lines.

* The 3rd, 4th, and 23rd day's urea were lost, hence 28 days only of the 31 taken.

CASE XXIV.

JANE M. Age 56. Housewife. Height 5 ft. 6 in. Weight 8 st. 4½ lbs. Fairly healthy-looking, but anæmic; *always* had to rise at night, even before coming to Poorhouse, but did not live on a porridge diet outside. She has now to rise twice and thrice in the night. She has been an inmate for three months, with diet No. 2 + beef.

DIET NOW No. 2. + BEEF.—WORKING AS A WARDER.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	136	1010	714	17	180	1010	540
2	210	1012	840	18	164	1010	492
3	188	1014		19	180	1010	540
4	170	1014		20	150	1010	525
5	152	1014	684	21	170	1022	1275
6	158	1017	1580	22	180	1020	900
7	196	1010	588	23	186	1020	
8	200	1012	700	24	170		
9	180	1022	1530	25	170	1016	935
10	180	1015	810	26	180	1010	720
11	184	1010	552	27	160	1015	600
12	150	1012	675	28	195	1020	975
13	180	1014	900	29	168	1022	798
14	170	1015	765	30	180	1018	900
15	180	1017	810	31	184	1015	644
16	168	1015	756				

DIET No. 2 with beef = 15 grammes Nitrogen daily: total in 27* days = ... 405 grammes.

Total **UREA** excreted in 27 days = 21,748 grains = 1409 grammes = of Nitrogen, 657 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . (say) 52 „ and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 40 „ } 749 { Total grammes Nitrogen excreted.

The difference = 344 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 10,320 grammes (*i.e.*, about 23 lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	13TH DAY.	31ST DAY.
4,200,000 : 65%	4,400,000 : 70%	4,800,000 : 80%

The urine was acid and contained neither albumin nor sugar throughout the observations. Weight now 8 st. 3 lbs. = loss of

* The 3rd, 4th, 23rd and 24th day's urea were not estimated—only 27 days are therefore counted.

1½ lbs. Diabetes insipidus suggests itself in this case, but she assures me that she had no thirst, and *never* drank water. I placed her in the hospital under strict observation, but she never could be detected either drinking water, or eating any food but that supplied.

See Chart for Urine and Urea lines.

CASE XXV.

Eliza C. Age 67. Height 5 ft. 1 in. Weight 6 st. 12 lbs. An active-looking little woman for her age. An inmate of the Poorhouse—off and on—for five years. Works in the Laundry from choice, as she likes to be busy; looks anæmic; organs healthy. Often requires to rise thrice in the night.

Diet No. 2 + Beef.—Working in Laundry.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	66	1020	561	10	80	1012	280
2	50	1020	450	11	70	1015	315
3	50	1020	350	12	75	1015	337
4	50	1010	175	13	60	1015	270
5	40	1011	140	14	60	1018	330
6	120	1010	360	15	40	1015	160
7	100	1010	300	16	60	1015	240
8	100	1013	325	17	60	1012	210
9	100	1014	400				

On this day, this woman left, and returned to Poorhouse after a fortnight's absence, when I resumed the observations. As she did not feel able for work, she became a "non-worker" on No. 2 diet without beef.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grain Urea.
18	60	1015	345	25	70	1019	403
19	40	1020	240	26	75	1017	394
20	60	1015	390	27	56	1018	336
21	70	1018	385	28	50	1019	312
22	70	1019	402	29	50	1020	300
23	75	1017	389	30	55	1020	385
24	70	1018	385	31	50	1020	325

Weight now 6 st. 12 lbs.

DIET No. $\begin{matrix} 2 \text{ with beef} & = 15 \\ 2 \text{ without beef} & = 12{\cdot}2 \end{matrix}$ grammes Nitrogen

daily: total in $\frac{17}{14}$ days = ... 255 + 170·8 grms.

Total **UREA** excreted in $\frac{17}{14}$ days = $\frac{5203}{4991}$ grains =			
$\frac{337}{323}$ grammes = of Nitrogen		157 + 150 gm.	
to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . .	(say)	12 + 12 „	
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . .	(say)	25 + 17 „	194 + 179 (Total grammes Nitrogen excreted.)

The difference = + 61 − 8·2 grms.,

which multiplied by 30 gives the equivalent in **FLESH**, $\frac{1830}{246}$ grammes (*i.e.*, about $\frac{4 \text{ lbs.) gain.}}{\frac{1}{2} \text{ lb.) loss.}}$

Red blood corpuscles in c. mm.; and percentage of Hæmogloblin.

1ST DAY.	17TH DAY.	45TH DAY.
4,100,000 : 70%	4,400,000 : 70%	3,600,000 : 60%

See Chart for Urine and Urea Lines.

It will be observed in this case that during the first seventeen days E. C. had a diet (No. 2 + beef) of the value of:—

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen and Carbon.	Calories.
Grammes .	87·5	44·8	324·5	=	15 − 217·7	= 2105·7

changed during the next fourteen days to—

Grammes .	69·7	13·9	324·5	=	12·2 − 185·5	= 1745·3

During the first part of the month she received proteids of the value of 15 grammes nitrogen daily, and apparently kept about 3·6 grammes daily. This showed that so long as the organism received this supply it could be kept, and therefore E. C. was far short of being in the normal state of nitrogenous equilibrium.

The more than double quantity of fat in the diet of the first part of the month, explains how she was enabled to keep her proteids to restore her nitrogenous tissues which were below *par*. During the second part of the month, the proteids offered to her were reduced to the value of 12·2 grammes nitrogen, and the fat to less than half—the carbohydrates remaining the same. She now apparently lost nitrogen at the average rate of 0·6 grammes daily, which loss is accounted for by the withdrawal of so much fat not allowing of the

conservation of the proteids in the diet.* I am sorry that the abrupt departure of E. C. upon the seventeenth day gave me no opportunity of taking her weight, which might, or might not, have been increased. The body-weight at the end of the whole observation in this case remains the same, *viz.*, 6 st. 12 lbs.; but, as I explain in the discussion of the subject as a whole, having no record of the fate of the C. and H. ingested, it is not possible to strike a balance of nutrition as regards "intake" and "output"; and variations in the body-weight are as much due to the metabolism of the C. and H. as the N. The large quantity of urine voided upon the sixth day (120 ounces) may be due to drinking water. It is accompanied by increased urea excretion. With this exception there has not been much increase in the daily average amount of urine excreted. In a normal healthy individual, the imbibition of large quantities of fluid does not *materially* increase the urea excretion; but the manner in which the red line roughly follows the black line in those charts in the large majority of the cases, suggests that in ill-nourished people, not in a state of nitrogenous equilibrium, but feeding, to a more or less extent, upon their nitrogenous tissues, a "watery" diet with increased excretion of urine is accompanied by the increased excretion of urea. The subject is discussed at the end of the series of observations.

* And had there been more urine voided in the 2nd experiment (14 days) the excretion of urea would have been higher.

GROUP III.

3 Males on No 2 diet (no beef) Value :—

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.		Calories.
Grammes	69·7	13·9	324·5	=	12·2	185·5	=	1745·3

CASE XXVI.

D. M'G. (male). Age 45. Stone polisher. Height 5 ft. 5 in. Weight 9 st. 2½ lbs. An inmate for six months—the first three on No. 1 diet, the remaining three on No. 2 diet. Had to rise (at first) very frequently at night to micturite; does not require to do so now.

Diet No. 2.—Doing no Work.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	65	1020	358	16	60	1012	300
2	60	1020	375	17	60	1013	330
3	70	1014	332	18	60	1015	360
4	60	1018	390	19	65	1015	455
5	55	1018	385	20	50	1022	500
6	65	1020	422	21	55	1023	440
7	60	1020	390	22	60	1025	480
8	60	1022	420	23	60	1020	480
9	60	1022	525	24	65	1025	552
10	65	1022	520	25	60	1027	510
11	60	1022	390	26	75	1022	450
12	60	1022	420	27	60	1020	540
13	65	1020	358	28	60	1022	390
14	60	1015	300	29	60	1022	390
15	65	1010	422				

Weight now 8 st. 13½ lbs. = a loss of 3 lbs.

Diet No. 2 = 12·2 grammes Nitrogen daily : total in 29 days = ... 353·8 grammes.

Total **UREA** excreted in 29 days = 12,184 grains = 789 grammes = of Nitrogen 368 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 29 ,,
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 35 ,,
= 432 grammes Nitrogen excreted.

The difference = 78·2 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 2,346 grammes (*i.e.*, about 5 lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	Day.
4,200,000 : 65%	Left Poorhouse—no record.

See Chart for Urine and Urea lines.

CASE XXVII.

P. M'G. (male). Age 45. Height 5 ft. 4 in. Weight 9 st. 3 lbs. An inmate for twelve months on No. 1 diet: no increased frequency of micturition complained of: sits in a warm room heated by steam pipes.

Diet No. 2.—No Work.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	60	1017	375	12	55	1022	412
2	65	1020	276	13	50	1020	400
3	65	1015	358	14	55	1020	385
4	60	1014	300	15	60	1020	420
5	65	1015	422	16	60	1020	390
6	60	1015	390	17	50	1024	375
7	55	1012	220	18	60	1020	360
8	60	1015	345	19	90	1015	405
9	55	1018	330	20	80	1020	360
10	55	1020	385	21	70	1024	455
11	60	1020	330				

Weight now 9 st. 5 lbs. = a gain of 2 lbs.

Diet No. 2 = 12·2 grammes Nitrogen daily: total in 21 days = ... 256·2 grammes.

Total **UREA** excreted in 21 days = 7,693 grains = 498 grammes = of Nitrogen 232 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 18 ,, and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 25 ,, = 275 (Total grammes Nitrogen excreted.)

The difference = 18·8 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 564 grammes (*i.e.*, about 1 lb.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	50th Day.
5,000,000 : 70%	4,800,000 : 70%

See Chart for Urine and Urea lines.

CASE XXVIII.

J. C. (male). Age 52. Height 5 ft. 6 in. Weight 10 st. 7 lbs. An inmate for three weeks on No 1 diet, and then three weeks on No. 2 diet: no increased frequency of micturition.

Diet No. 2.—Doing no Work.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	40	1018	240	9	40	1020	300
2	50	1017	300	10	45	1020	292
3	45	1016	270	11	40	1015	200
4	40	1015	260	12	45	1018	315
5	50	1020	400	13	45	1015	248
6	48	1022	408	14	48	1020	300
7	45	1022	382	15	60	1012	330
8	50	1020	400	16	50	1012	300

Weight now 10 st. 4½ lbs. = 2½ lbs. loss.

Diet No. 2 = 12·2 grammes Nitrogen daily: total in 16 days = ... 195·2 grammes.

Total **UREA** excreted in 16 days = 4,945 grains = 320 grammes = of Nitrogen 149 grammes;
to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 12 ,,
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 19 ,,

180 { Total grammes Nitrogen excreted.

The difference = 15·2 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 456 grammes (*i.e.*, about 1 lb.) gain.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	16th Day.	50th Day.
4,800,000 : 75%	4,200,000 : 70%	4,400,000 : 60%

See Chart for Urine and Urea lines.

GROUP IV.

Some special combinations in diets.

CASE XXIX.

J. S. (male). Age 63. Height 5 ft. 5 in. Weight 7 st. 1½ lbs. An inmate for twelve years, and for the last six he has been on No. 2 diet, with rice soup *every* day (for broth), and beef; *works* as a warder in hospital; no increased micturition complained of.

DIET No. 2, with ½ pint skim milk (for ¾ pint buttermilk), rice soup (for broth), and beef with bread; also ¼ oz. butter.

Days.	Oz. Urine.	Sp. Gr.	Grains. Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	50	1020	400	17	50	1020	350
2	60	1018	465	18	60	1020	420
3	50	1017	325	19	55	1022	385
4	55	1017	330	20	55	1022	399
5	60	1018	360	21	50	1022	325
6	55	1020	344	22	50	1020	350
7	60	1020	450	23	55	1022	385
8	50	1022	412	24	50	1020	350
9	65	1023	472	25	50	1020	363
10	60	1016	450	26	50	1020	350
11	65	1020	423	27	50	1022	375
12	55	1020	412	28	50	1020	363
13	50	1017	375	29	50	1020	350
14	50	1020	388	30	50	1020	375
15	60	1020	540	31	55	1020	440
16	75	1019	488				

Weight now 7 st. 2 lbs. = ½ lb. gain.

The value of the diet is =

	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.	Calories.
Grammes	75·8	52·4	315·2 =	13·3	207 =	2090·3

DIET. No. 2 + ½ pint skimmed milk; rice soup + beef = 13·3 grammes Nitrogen daily: total in 31 days = 412·3 grammes.

Total **UREA** excreted in 31 days = 12,214 grains = 791 grammes = of Nitrogen 369 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 29 „
and also add 10 per cent. Nitrogen, taken and lost in the fæces . . (say) 41 „

439 { Total grammes Nitrogen excreted.

The difference = 26·7 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 801 grammes (*i.e.*, about $1\frac{3}{4}$ lbs.) loss.

Red blood corpuscles in c. mm. ; and percentage of Hæmoglobin.

1st Day.	21st Day.	52nd Day.	82nd Day.
4,800,000 : 70%	4,800,000 : 75%	4,400,000 : 55%	4,800,000 : 70%

See Chart for Urine and Urea lines.

Unlike the majority of the cases, there is no deficiency of fat in this diet. The carbohydrates are not materially diminished, and therefore the defect in this diet appears to be the smaller quantity of nitrogen taken in the food. It amounts to only 13·3 grammes as compared with the 17·6 grammes of the No. 1 + beef diet, and the 15 grammes of the No. 2 + beef diet of the "working" inmates.

The cause of the diminution of nitrogen taken, is the lower value of the rice soup, which he prefers *every* day, to the broth and pea soup. The water in the diet amounts to about seventy ounces. Excepting tea, there is no diuretic agent in the diet, and consequently there is no polyuria to be noted, and no abnormally increased excretion of urea. The total "output" of nitrogen, however, is still slightly in excess of the "intake," and the gain of $\frac{1}{2}$ lb. in body-weight—if not due to a full bladder or rectum—can only be due to some gain of fat or stored up glycogen.

(This case is again alluded to at the end of the observations, when dealing with the deductions and conclusions arising from the whole series of observations. The point of interest which may be noted here, is that the nitrogen in the diet is slightly below the minimum amount necessary to preserve the N-equilibrium, notwithstanding the diet being rich in fat. Compare with Case XXXI., where the nitrogenous loss is still greater, with a still further diminutio nof the nitrogen "intake," in a diet very poor in fat.)

CASE XXX.

John M'P. Age 48. Height 5 ft. 4 in. Weight 7 st. $12\frac{1}{2}$ lbs. Barber; organs healthy; anæmic; feels "done up" about two o'clock in the afternoon; his work was only to shave the paupers upon certain days; had to rise at night to micturite at first coming to the Poorhouse, but does not require to do so now; had a varicose ulcer when first admitted (now quite healed). During the last three years his diet has been practically No. 2, but on "shaving" days he got beef (say twice weekly)—sometimes not.

As this man is a useful inmate, I feel quite sure that he could have got a better diet had he wished it. Apparently he has been quite satisfied. He certainly does not look a man of robust appetite.

Diet No. 2. with Beef twice weekly.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	50	1015	225	17	80	1018	320
2	45	1013	203	18	75	1020	662
3	45	1012	146	19	75	1024	662
4	50	1012	175	20	70	1020	350
5	100	1013	400	21	75	1014	375
6	90	1015	405	22	70	1015	420
7	90	1015	450	23	75	1012	375
8	90	1020	630	24	70	1015	385
9	80	1017	360	25	65	1016	455
10	70	1015	245	26	60	1015	420
11	82	1015	328	27	70	1016	490
12	80	1015	360	28	65	1016	552
13	75	1010	225	29	75	1010	357
14	80	1015	380	30	70	1015	368
15	90	1013	405	31	75	1015	338
16	75	1015	337				

Weight 7 st. $12\frac{1}{2}$ lbs. = no loss nor gain.

Diet No. 2 without beef = 12·2 grammes Nitrogen daily: total in 31 days = ... 378·2
(Nine "beefs" = 25·2 grammes Nitrogen) . . 25·2

403·4 grammes.

Total **UREA** excreted in 31 days = 11,803 grains = 764 grammes = of Nitrogen 356 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 28 „
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 40 „

424 { Total grammes Nitrogen excreted.

The difference = 20·6 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 618 grammes (*i.e.*, about $1\frac{3}{8}$ lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	29th Day.	92nd Day.	120th Day.
4,100,000 : 70%	4,600,000 : 75%	5,000,000 : 65%	4,600,000 : 70%

See Chart for Urine and Urea lines.

CASE XXXI.

R. F. (male). Age 50. Height 5 ft. 6½ in. Weight 8 st. 8¾ lbs. An inmate for seven years, being somewhat weak mentally; is on No. 2 diet with tea in the morning as at night, and has been on this diet, by choice, for a considerable time; does not require to rise at night.

DIET NOW THE SAME, *i.e.*, No. 2 DIET, with tea and bread in the morning instead of porridge and buttermilk.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	50	1025	500	17	45	1023	360
2	65	1022	585	18	50	1022	375
3	60	1025	510	19	50	1023	388
4	50	1025	450	20	45	1025	395
5	45	1027	450	21	40	1022	280
6	50	1023	475	22	45	1022	360
7	45	1025	360	23	50	1020	400
8	45	1025	338	24	45	1021	382
9	45	1026	360	25	45	1022	360
10	50	1023	388	26	45	1023	360
11	55	1022	412	27	50	1020	400
12	45	1025	360	28	50	1022	375
13	50	1023	400	29	45	1020	318
14	50	1022	338	30	50	1020	375
15	50	1023	325	31	45	1021	405
16	50	1022	350				

Weight now 8 st. 8¼ lb. = loss of ½ lb.

DIET No. 2 with bread and tea in the morning and at night = 10·1 grammes Nitrogen daily: total in 31 days = ... 313·1 grammes.

Total **UREA** excreted in 31 days = 12,134 grains = 786 grammes = of Nitrogen 366 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 29 „
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 31 „
} 426 { Total grammes Nitrogen excreted.

The difference = 112·9 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 3,387 grammes (*i.e.*, about 7 lbs.) loss.

Red blood corpuscles in c. mm. ; and percentage of Hæmoglobin.

1st Day.	27th Day.	70th Day.
4,800,000 : 60%	4,800,000 : 70%	4,200,000 : 50%

See Chart for Urine and Urea lines.

This is a very poor diet, consisting of bread and tea, morning and night, with the ordinary bread and broth for dinner. He will not take porridge, nor beef, when offered it. The value of this diet, when extended out=

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.		Calories.
Grammes	57·8	11	342·8	=	10·1	190·6	=	1744·6

The value of the diet is thus only slightly better than the "starvation" diet quoted in the Table. This was the only inmate found with such a diet, and when the completion of his case revealed the poor character of his diet, he was removed to the hospital, and put upon a more generous one. The amount of water in his diet amounted to about fifty ounces, and the excretion of urine was correspondingly low. There is no abnormal excretion of urea (when the daily average is estimated) but the *relative* amount of nitrogen excreted is largely in excess of the nitrogen taken in the food, being equal to an equivalent of 7 lbs. loss in flesh. The body-weight, however, shows only a loss of half a pound.

As there is no diuresis here, the explanation appears to be simply, deficiency in the amount of nitrogen taken, and the absence of a sufficiency of fat, which would enable him to preserve his nitrogenous tissues, upon which he was apparently feeding.

CASE XXXII.

Lily B. Age 56. Height 5 ft. 2 in. Weight 7 st. 7 lbs. Heart and kidneys healthy: speech affected, but no paralysis. A hospital case doing no work. Just shortly admitted. No increased micturition complained of.

Diet No. 2. + Beef Tea and Sweet Milk.
(In bed and convalescent.)

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	24	1025	240	6	52	1020	338
2	51	1015	280	7	60	1015	240
3	30	...	...	8	56	1021	364
4	30	...	...	9	90	1022	765
5	48	1020	336	10	54	1022	243

CONTINUED.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
11	72	1012	234	22	70	1014	403
12	90	1018	495	23	60	1020	300
13	60	1020	300	24	70	1020	280
14	70	1015	350	25	80	1015	280
15	70	1015	280	26	70	1025	595
16	90	1020	630	27	50	1018	287
17	70	1015	350	28	70	1012	280
18	50	1020	375	29	80	1012	360
19	70	1012	350	30	58	1012	232
20	64	1017	320	31	64	1017	320
21	56	1015	386				

Weight 8 st. = gain of 7 lbs.

DIET No. 2, with beef tea and sweet milk = 12·3 grammes Nitrogen daily: total in 29* days = . . 356·7 grammes.

Total **UREA** excreted in 29 days = 10,213 grains = 661 grammes = of Nitrogen 308 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 24 ,,
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 35 ,,
367 { Total grammes Nitrogen excreted.

The difference = 10·3 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 309 grammes (*i.e.*, about ½ lb.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1ST DAY.	15TH DAY.	32ND DAY.	100TH DAY.
4,200,000 : 65%	4,400,000 : 70%	4,800,000 : 70%	4,600,000 : 65%

See Chart for Urine and Urea lines.

CASE XXXIII.

Robert H. Age 55. Height 5 ft. 11½ in. Weight 11 st. 8 lbs. Bookseller. Organs healthy; looks anæmic; has been in Poorhouse for nine months, acting as a warder on No. 2 + beef and other extras. Requires to rise sometimes three times at night to micturite since coming to Poorhouse.

* The 3rd and 4th day's urea being lost.

Diet No. 2 + Beef.—
With 1 pint Skimmed Milk for ¾ pint Buttermilk.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	120	1010	480	17	100	1015	500
2	100	1012	375	18	105	1014	630
3	105	1010	446	19	100	1015	650
4	110	1010	440	20	105	1015	630
5	120	1015	510	21	100	1017	650
6	110	1017	605	22	100	1015	600
7	100	1012	450	23	95	1016	522
8	100	1012	450	24	100	1015	550
9	110	1012	440	25	100	1012	550
10	105	1010	525	26	100	1013	550
11	115	1013	518	27	95	1015	547
12	100	1010	475	28	100	1015	550
13	100	1012	300	29	100	1015	500
14	120	1010	450	30	95	1016	522
15	110	1010	440	31	100	1015	500
16	100	1016	600				

Weight now 11 st. 7 lbs. = a loss of 1 lb.

Diet No. 2 with beef and 1 pint Skimmed Milk = 16·6 grammes Nitrogen daily: total in 31 days = . 514·6 grammes.

Total **UREA** excreted in 31 days = 15,955 grains = 1,033 grammes = of Nitrogen 482 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method. . (say) 38 ,,
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 51 ,,

571 { Total grammes Nitrogen excreted.

The difference = 56·4 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 1,692 grammes (*i.e.*, about 3¾ lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	31st Day.	80th Day.	112th Day.
4,400,000 : 80%	4,800,000 : 65%	4,800,000 : 55%	5,000,000 : 85%

The substitution of 1 pint Skimmed Milk for ¾ pint buttermilk increases the quantity of nitrogen taken by 1·2 grammes daily; the amount of fat, 5·4 grammes, and carbohydrates, 5 grammes *daily*.

See Chart for Urine and Urea lines.

CASE XXXIV.

John F. Age 58. Retired from army. A slender man of 9 st. Height 5 ft. 7½ in. Organs healthy; looks anæmic. An inmate for six months although occasionally going out during that time; had no necessity for rising to micturite at night until he came to the Poorhouse; the diet was always No. 2 + beef, a few days after admission.

DIET NOW No. 2 + BEEF TEA; AND SWEET MILK FOR THE BUTTERMILK.—WORKED HARD AS A WARDER IN THE HOSPITAL.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	80	1020	640	17	90	1015	540
2	100	1020	800	18	100	1018	650
3	110	1016	687	19	95	1015	475
4	110	1021	880	20	90	1020	630
5	110	1015	880	21	100	1020	650
6	100	1016	650	22	95	1020	570
7	110	1020	825	23	100	1020	600
8	90	1020	675	24	90	1017	675
9	110	1015	660	25	95	1025	879
10	100	1020	700	26	90	1015	382
11	100	1020	750	27	95	1020	712
12	100	1020	750	28	90	1020	720
13	90	1020	675	29	85	1020	701
14	90	1015	495	30	92	1015	552
15	100	1017	600	31	90	1025	765
16	100	1020	600				

He admits drinking a good deal of water during the observation.

Weight 8 st. 12 lbs. = a loss of 2 lbs.

DIET No. 2. + beef-tea and ½ pint sweet milk = 12·3 grammes Nitrogen daily: total in 31 days = . . 381·3 grammes.

Total **UREA** excreted in 31 days = 20,768 grains = 1,345 grammes = of Nitrogen 627 grammes; to which add 8 per cent. Nitrogen, not estimated by the Hypobromite method . . (say) 50 „
and also add 10 per cent. Nitrogen taken, and lost in the fæces . . . (say) 38 „

715 } Total grammes Nitrogen excreted.

The difference = 333·7 grammes,

which multiplied by 30 gives the equivalent in **FLESH**, 10,011 grammes (*i.e.*, about 22 lbs.) loss.

Red blood corpuscles in c. mm.; and percentage of Hæmoglobin.

1st Day.	11th Day.	31st Day.
3,200,000 : 70%	4,800,000 : 85%	5,200,000 : 85%

45th Day (after 14 day's absence from the Poorhouse.)	103rd Day.
4,800,000 : 75%	4,000,000 : 70%

See Chart for Urine and Urea lines.

This case left the Poorhouse for a fortnight on receiving his pension. While outside he lived upon tea and bread for breakfast, with occasionally an egg; dinner, some stewed meat (¼ lb.) with potatoes, but sometimes no dinner; tea and bread at night. He took also whisky *occasionally*, according to his own statement. Beginning a second series of observations, I found his weight 8 st. 6¾ lbs. = a loss of 5¼ lbs. since leaving the Poorhouse. He states that he did not require to rise at night to micturite while outside.

Diet now No. 1.—Doing no Work and Drinking no Water.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	90	1015	495	3	100	1020	600
2	110	1018	550	4	90	1015	294

1 pint *skimmed* milk was now given in place of the 1½ pints buttermilk. Still doing no work and drinking no water.

5	90	1015	384	7	70	1014	280
6	70	1012	263	8	65	1025	455

Here he was again put on No. 2 diet with beef tea and sweet milk (½ pint) same as first diet. (No work.) (No water).

9	90	1015	518	12	90	1015	540
10	90	1010	340	13	80	1015	400
11	80	1015	400				

Here he was directed to drink water.

Water Oz.				Water Oz.			
20 — 14	110	1012	440	20 — 16	110	1010	412
30 — 15	115	1012	460	20 — 17	100	1015	500

Here he was supplied with oatcakes for the porridge in the morning; and drinking water stopped.*

18	90	1015	450	20	65	1014	325
19	70	1015	245				

Weight now 8 st. 4½ lbs. = 2¼ lbs. loss.

* The oatcakes were made of 4 oz. oatmeal—the same quantity of oatmeal as in one porridge. This reduced the water in the diet to (about) 60 ounces.

In the first observation, running for one month, this man was on No. 2 diet with beef tea, and ½ pint sweet milk for ¾ pint of buttermilk. It is the lowest invalid diet, and it was deemed most suitable for him at the time, he being alcoholic. He wished to work, so he occupied himself as warder in the hospital, drinking a good deal of water, and working hard. The value of this diet is :—

	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.	Calories.
Grammes .	70·8	25·1	329	= 12·3	201·6	= 1872·5

He passed about an average of 100 ounces urine daily, and the excretion of urea over the month, as recorded in the Chart, is very large in amount, and represents nearly double the quantity of nitrogen taken in the food.

It is difficult to account for the small loss of body-weight in relation to the equivalent loss of *flesh* represented by the nitrogen.

In this case, the nitrogenous part of the diet was low, and the amount of fat was moderate, but below that of the No. 2 + beef diet usually given to workers. The *hard* work on this *low* diet apparently is the cause of the increased urea excretion. This does not occur under normal conditions, *work* not increasing the excretion of urea to any considerable extent in healthy, well-nourished labourers. The body-weight of this man indicates that he has no store of fat to draw upon, and hence the demand made upon his nitrogenous tissues.

On his return he was again weighed and instructed *not to work nor to drink water.* He was then put under strict observation for the further investigations, as recorded opposite.

(1) *Four* days on *No. 1* diet, valued at

Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
83·5	17·3	333·8	=	14·8	194·2

The total nitrogen taken = 14·8 × 4 = 59·2 grammes.
The total nitrogen excreted (estimated as in charts) . . . = 67·0 grammes.
showing a loss of nitrogen = 7·8 grammes (8 oz. flesh).

(2) He was then kept on the same diet with *skimmed* milk for the buttermilk, for *four* days. The value of the diet =

	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
Grammes .	83·5	22·6	338·7	= 14·8	196·2

The fat and carbohydrates in this diet are only slightly increased. The amount of nitrogen remains the same. The water taken is reduced about ½ pint. The effect of the with-

drawal of the acid buttermilk, and the substitution of skimmed milk, reduces the diuresis, even allowing that there are 10 ounces of fluid less taken.

The nitrogen taken . . . = 60·8 grammes.
The nitrogen excreted (estimated as in the Charts) . . . . = 50 grammes.
hence there has been a gain of nitrogen equivalent to 11 ounces flesh.

(3) He was again placed upon the original diet (No. 2 with beef tea and sweet milk) for five days, but doing no work. The Chart shows the increased amount of urine again, although not so much as in the first experiment with No. 1 diet (buttermilk). The fluid in this third diet amounts to about 80 ounces—*i.e.*, 20 ounces less than in the first experiment, and 10 ounces less than in the second. Granting that the conditions remained the same, the increased diuresis would appear to be due to the *tea*. It does not, however, produce so much excretion of urine as the buttermilk diet does : but the difference in this respect, in relation to the first experiment, is only the 20 ounces less water in the diet of this, the third experiment.

What I wish to point out, is, that in the first and third experiments, there are diuretic agents in the diets given, which appear to be about equal in degree, the relative quantities of water (100 : 80 oz.) in these diets being considered ; but in the *second* diet, while the fluid taken stands midway between that of the first and third diets (*viz.*, 90 ounces) yet there is a diminished excretion of urine—hence it appears that in this (the skimmed milk experiment) there is no diuretic action, and *no* increased urea excretion, but the contrary, a gain of nitrogen = to 11 ounces flesh, as stated. The loss in the third experiment —15·5 grammes nitrogen in five days = 1 lb. flesh (which in four days = about 13 ounces).*

(4) The fourth experiment is merely the addition of water, by drinking, from time to time, during the day,—the patient keeping perfectly quiet. The rise in the quantity of urine excreted is shewn in the Chart. The quantity of nitrogen excreted in this experiment was in excess of that taken, by as much as is equivalent to a loss of 14 ounces flesh. It will be noticed in the Chart, however, that the red line of the urea does not rise materially with the increased excretion of the urine, as it does in most of the cases. It might be argued that increased urea excretion had been started in the previous

* Compare this loss with the great loss of N. recorded on page 59 while on exactly the same diet, but *working hard*, and drinking water.

five days' experiment, and was maintained by the continuance of the defective diet, so that increased polyuria only served to extract (by the kidneys) what already had been fully established.

(5) The fifth experiment is simply the reducing of the water in the diet by replacing the porridge with oatcakes, made from the same quantity of oatmeal. The water in the diet is reduced to about 60 ounces. The lines in the Chart shew diminished urine and urea excretion. Over the three days there is practically nothing gained or lost.

The total gains and losses are as follows :—

1st four days	: N = 8 oz. flesh *loss.*		
2nd ,, ,,	: N =	11 oz. flesh *gain.*	
3rd five ,,	: N = 13 ,, ,, ,,		
4th four ,,	: N = 14 ,, ,, ,,		
5th three ,,	: N = 0		
		35 oz. loss.	11 oz. gain.

Total—Loss of 24 oz.

The body-weights show a loss of $2\frac{1}{4}$ lbs.

(The case is again alluded to at the end of the "Observations.")

CASE XXXV.

A. M'L. Age 44. Height 5 ft. 9 in. Weight 11 st. $11\frac{7}{8}$ lbs.; in the hospital with a chronic ulcer of the leg for five weeks, on No. 2 diet with beef tea and sweet milk ($\frac{1}{2}$ pint) for buttermilk; does not require to rise at night to micturite. Looks pale and flabby.

Diet No. 2 + Beef Tea and Sweet Milk continued ; *in bed.*

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	60	1020	420	4	70	1020	420
2	65	1023	520	5	100	1015	425
3	70	1019	385				

Weight after emptying bladder = 11 st. $11\frac{7}{8}$ lbs.

Now put on No. 1 diet.

6	100	1020	650	9	100	1020	650
7	100	1020	600	10	130	1020	845
8	100	1021	625	11	90	1019	585

Weight *every* day as before = 11 st. $11\frac{7}{8}$ lbs. $1\frac{1}{2}$ pints *skimmed* milk now given for the $1\frac{1}{2}$ pints buttermilk in No. 1 diet—the remaining parts of the diet, the same as before.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
12	105	1016	472	15	85	1017	425
13	90	1018	382	16	80	1019	440
14	85	1020	467	17	90	1017	450

Here he was placed upon a dry diet—oatcakes being given instead of porridge.

18	85	1018	468	21	60	1025	510
19	80	1018	520	22	55	1027	550
20	60	1025	540	23	50	1023	400

Here he was placed upon No. 2 diet with ¾ pint skimmed milk instead of buttermilk.

24	60	1020	420	26	70	1020	420
25	65	1021	455				

Here he was placed upon No. 1 diet with skimmed milk for the buttermilk; the broth removed; and 4 ounces beef, followed by suet pudding for dinner.

Weight 11 st. 11 lbs.

27	75	1020	450	30	70	1020	490
28	65	1024	455	31	60	1020	420
29	70	1024	525				

Weight now 12 st. 2 lbs.

Notes on Case No. XXXV. (A. M'L.) in Bed.—Drinking no Water and doing no work throughout.

(1) The first five days, A. M'L., weighing 11 st. 11⅞ lbs., was placed upon No. 2 diet, with ½ pint of sweet milk, and ½ pint of beef tea (invalid diet). The value of this diet =

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes	70·8	25·1	329	=	12·3	201·6

The total nitrogen taken = . . 12·3 × 5 = 61·5 grammes.
The total nitrogen excreted (estimated as in the Charts) = . 76 ,,

showing a *loss* of . . . 14·5 ,,
nitrogen in five days = about 1 lb. *flesh*.

(2) He was then placed upon No. 1 diet, valued at =

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes	83·5	17·3	333·8	=	14·8	194·2

The total nitrogen taken = . 14·8 × 6 88·8 grammes.
The total nitrogen excreted = . 136 ,,

showing a *loss* of nitrogen . 47·2 ,,

=about 3 lbs. *flesh*. The body-weight, every day, remained throughout 11 st. 11⅞ lbs.—the weights being taken with great care.

(3) The diet now remained the same as in the previous experiment, with only the substitution of 1½ pints *skimmed* milk for the *same* quantity of buttermilk. The value of this diet being :—

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes	93·7	25·4	350·8	=	16·4	201·4

Unlike the second experiment in the case of J. F., Case No. XXXIV., the skimmed milk is given in the same quantities as the buttermilk of the previous experiment, hence the amount of fluid is the same in this diet. It will be observed, however, that the polyuria is diminished by the withdrawal of the buttermilk.

The substitution of the skimmed milk for the buttermilk raises the value of the diet slightly (compare the figures).

The total nitrogen taken = . 16·4 × 6 = 98·4 grammes.
The total nitrogen excreted = . 94 ,,

showing now a *gain* of . . 4·4 ,,
=about 5 ounces flesh in the six days.

(4) This is the same diet, but the oatmeal was made up into *cakes*, instead of porridge, in order to observe the effects of a *dry diet*.

The excretion of urine is much diminished.

The total nitrogen taken = . 16·4 × 6 = 98·4 grammes.
The total nitrogen excreted = . 106 ,,

showing a *loss* of nitrogen . 7·6 ,,
=about ½ lb. *flesh* in six days. The amount of water in this diet=about 60 ounces. The apparent effect of the dry diet, in this case, has been rather to increase the excretion of urea slightly, notwithstanding the reduction in the amount of water given and excreted.

(5) The diet was now changed to No. 2, with ¾ pint of skimmed milk for the same quantity of buttermilk. The value of this diet=

	Proteids.	Fat.	Carbo-hydrates.	Nitrogen.	Carbon.
Grammes	74·9	17·9	333	13	189·1

The total nitrogen taken = . . 13 × 3 = 39 grammes.
The total nitrogen excreted = . . 44 ,,

showing a *loss* of nitrogen . . 5 ,,
=about 5 ounces loss of flesh in three days. The amount of

water in this diet is about 76 ounces. His weight at this stage was 11 st. 11 lbs., *i.e.*, a loss of 14 ounces.

(6) He was now placed upon No. 1 diet, with skimmed milk for the buttermilk ; and bread, beef, and suet pudding for dinner. The suet pudding contained 1 ounce of suet and 3 ounces of flour. The value of this diet being :—

	Proteids.	Fat.	Carbo-hydrates.	= Nitrogen.	Carbon.
Grammes	107·7	84·5	358·8	19·1	258·4

The amount of water in this diet is about 75 ounces.

The total nitrogen taken = .	.19·1 × 5	95·5 grammes.
The total nitrogen excreted = .		84 ,,
showing a *gain* of nitrogen . .		11·5 ,,

= about 12 ounces *flesh* in the five days.

The body-weight was now found to be 12 st. 2 lbs., a gain of 5 lbs. in the five days he was on the richer diet. This case is again referred to (pages 69, 73).

DISCUSSION OF THE DIETS AND THEIR EFFECTS UPON EXCRETION BY THE KIDNEYS, AND UPON THE BLOOD.

In the first part of this work I have dealt with the diets of the inmates of Scottish Poorhouses, and extended out their nutritive values. I have shewn their relative positions and values to other public dietaries; and I have also given the results of my analyses to determine the amount of iron in the two diets with which we are principally concerned, in relation to the anæmia present in most of the inmates.

Having concluded the series of observations made upon the inmates of Craigleith Poorhouse, I propose now to discuss the subjects in reverse order, *viz.* :—

I. The abnormal conditions revealed by the observations; and the defects in the diets causing these conditions.

II. The iron in the diets in relation to the anæmia present in the inmates; and

III. The consideration of the diets themselves, their relations and their defects, and how far these may be improved and corrected.

I. The Abnormal Conditions Revealed by the Observations, and the Defects in the Diets causing these Conditions.

It is evident, on looking through these charts, and the collected information relating to each case, that the chief point of interest is the disturbance of the nitrogenous equilibrium in the subjects living upon these diets. In a large proportion of the cases we find that a mild form of polyuria is established, not only inconvenient in itself, but associated with a greatly increased excretion of urea. During the course of the observations attention has been drawn, by special notes, to particular points of interest in individual cases; but I now desire, with as little repetition as possible, to discuss these abnormal conditions with the collected evidence of these observations before us.

(A) What is the cause of the Polyuria?

In nearly all of the cases examined, the increased frequency of micturition, by day as well as by night, has been complained of; and if any inmate be questioned on the subject, he almost invariably states that he passes far more urine while in the Poorhouse than he does at other times. It may be taken that the cases recorded here are fair samples of the whole, as no selection has been made. (The symptom is also present in the case of the prisoners in Calton Prison, who are on similar diets.)

A critical examination of the food-stuffs used in the preparation of the diets does not, with the exception of the oatmeal and buttermilk, suggest that any deleterious or diuretic agent is present. The possibility of oatmeal being diuretic in action led me to consult various authorities; but all I have been able to find in relation to this subject is the following, quoted from the sixth edition of Von Wolff's "Landwirtschaftliche Fütterungslehre":—"It is still an open question whether the excellent feeding effect of oats on horses is due to a stimulation of the nervous system by a peculiar substance contained in oats, which has been called *Avenin;* and it is still more uncertain, whether the increased milk production of cows fed on oatmeal is due to the same cause."

A "Tincture of Avenin" has been placed upon the market by American chemists, but as it finds no place in the U.S. Dispensatory, it may be dismissed from consideration.

It is needless, however, to seek for a very doubtful cause in the oatmeal used when more obvious causes suggest themselves, which are sufficient to account for the mere increase of water in the kidney secretion. It was a matter of surprise to me, and to those who had been serving porridge to the inmates for many years, to find that when a bowl of porridge was turned out upon the scale, it weighed 1 lb. 9 oz. That is to say, without reckoning the water in the meal itself, there were actually 21 ounces of water given, with each porridge which contained only 4 ounces of oatmeal.

In addition to the water in the diets (amounting to about 100 ounces in No. 1, and about 75 ounces in No 2) there is, in buttermilk, a diuretic agent, which in the majority of cases increases the urinary secretion. This is clearly shown in Case No. XXXIV., pages 59-63.

The *first* four days—this man in the Hospital Ward, doing no work, and drinking no water beyond that in the diet, which

amounts to 100 ounces—voided an average of 97½ ounces daily. In the *second* four days, under exactly the same conditions, with *skimmed milk* for the buttermilk—the average quantity of urine passed was 73¾ ounces daily. However, as only 1 pint of skimmed milk was given in this case for 1½ pints buttermilk, the amount of fluid in the second diet was 10 ounces less than in the first. Still, allowing for this, the buttermilk seems accountable for the difference, *viz.:* about 15 ounces.

The same experiment was repeated in Case XXXV., p. 63 —a man of fair weight suffering from a chronic ulcer of the leg. He remained in bed and drank no water. For *six* days he was on No. 1 diet (*i.e.*, buttermilk) and passed an average, daily, of slightly over 103 ounces. The *second* six days he was kept upon the same diet with the same quantity of *skimmed milk* for the buttermilk—so that the fluid portions of the diet remained the same—and the urine passed amounted to slightly over 89 ounces, average, daily. That is to say, in both observations, the urine amounted to as nearly as possible about 15 ounces more daily when the buttermilk was taken—the fluid portion of the diets being equal in quantity, and the diets in all other respects the same. The two experiments are also supported by the fact that if a rough average be struck of the amount of urine passed by those on No. 1 diet, and compared with the amount of urine passed by those on No. 2 diet, and allowing for the difference of water in the two diets, the amount of urine passed is relatively higher in the buttermilk diet. (In checking this observation, the *males* only should be taken, and one on No. 2 diet excluded, on account of his drinking large quantities of water. The female cases cannot be taken, for the special reasons stated in Ann Q. and Jane M.'s cases, pages 43 and 45.)

As in a very large number of the inmates there is increased urea excretion, it is also possible that the urea—which is in itself a diuretic—may keep up the polyuria, once established.

The variations in the daily amount of urine passed by the inmates, are, of course, accounted for by the loss of water by the skin or lungs. Drinking water, while at work, will increase the amount, and diminution in the quantity of urine passed by a man who is a "non-worker" may be due to his preference for sitting in rooms heated by steam pipes. Although the inmates are classified as workers and non-workers, yet the "non-worker" may if he choose do a little work—generally a very short spell —and this may account for variations in the amount of urine in this class.

Seeing that the polyuria cannot further be separately dis-

cussed from the more important abnormal condition of the increased urea excretion, I may sum up here that with regard to the *simple increase* of urine secreted by the Poorhouse inmates, there are two, and possibly three, factors, *viz.* : The "watery" construction of the diets ; the diuretic action of the lactose in the buttermilk ; and the increased urea excretion, present in most of the cases, keeping up a double reaction.

(B) The Increased Excretion of Urea.

In again glancing through these charts, it will be noticed that the red "urea line," more or less roughly, follows the course of the black "urine line." That is to say, that the increase or decrease of the polyuria is associated with an increase or decrease of the urea excreted. To this rule, there are some apparent exceptions, if single days only be regarded. Sometimes the urea excretion lags behind a day, and the rise of the red line is observed upon the day following the increased *urine* excretion (black line). In *no* case have I observed the reverse—*i.e.*, the red line (increased urea) rising before the black line (increased urine), so long as the previous relations of the lines are kept in view. The complicated nature of digestive processes does not allow of any practical deductions being made regarding these variations.

In relation to *normal* excretion of urea in healthy, well-nourished individuals—taking 450-500 grains urea as a fair daily average—it may be seen that more than half of the cases observed show an excretion of urea above the average—sometimes very much so. With very few exceptions, the greater the amount of urine passed, the greater is the excretion of urea ; and, as a rule, those cases on the more "watery" diets or who have imbibed much water are highest in both respects. It has sometimes appeared to me that the water included in the diets favoured an increase of urea excretion, while water imbibed at other times seemed to make no impression upon the excretion.

When, however, we come to examine the relations of the nitrogen taken in the food, and compare it with the nitrogen excreted by the kidneys, allowing an authenticated percentage not estimated by the methods used, we find in by far the larger proportion of the cases, the "output" is greatly in excess of the "intake," *i.e.*, the expenditure is in excess of the income. The exceptional cases may all be accounted for by their being better nourished to begin with (as shewn by the body-weights) or on better diets, with little or no work, &c.

The gains also are very slight in amount with the exception of one small-made woman. The observations show, then, that nearly all of the inmates upon the regular official pauper diets are not in a state of nitrogenous equilibrium. We know that polyuric conditions are almost always associated with increased urea excretion, but if we were to say that the former was the cause of the latter condition, it would not be correct. There is no doubt, however, that polyuria is a factor concerned with the increased production of urea. The increased water secreted supplies the necessary vehicle for the removal of the urea in excess. We can readily believe, also, that the presence of a large quantity of water in the body is favourable to more perfect reaction and combustion in the complicated chemical changes concerned with digestion, just as the presence of water is necessary in the reaction of chemical agents in a beaker. It is known, and is shown in the case of a well-fed man who kindly lent himself to the experiment,* that in healthy individuals the imbibition of large quantities of fluid does not materially increase the excretion of urea, and certainly it does not do so to the extent of an abnormal increase, such as occurs in the paupers whose cases are here recorded. Even with the addition of the diuretic buttermilk, used in the case above-mentioned, does it produce any material increase, and in the case noted there is actually a decrease. There must, therefore, be some antecedent cause producing the abnormal condition, and I think I shall be able to prove that there are several factors, combining to produce it.

The digestion of the proteids, and their conversion into albumoses and peptones, may be followed step by step to the intestinal cells, where apparently they undergo a change into the serum-albumin and serum-globulin of the blood. These albumins are carried by the circulation to nourish the tissues, and the circulation receives and carries back the waste products. So far, it is possible to trace the "ingoing" tide, although it

* Case of a healthy individual. Age 40. Height, 5 ft. 8 in. Weight 12 stone. Living on—Breakfast=porridge and sweet milk; dinner=soup, stewed beef, and potatoes; tea=bread and butter in the afternoon, and a glass of milk with a little bread at night.

Remaining on this diet for five days, the following notes were taken, viz. :—

Days.	Oz. Urine.	Sp. Gr.	Grains Urea Excreted.
1	66	1015	462
2	66	1018	396
3	66	1020	429
4	60	1025	480
5 = The diet remained the same, but forty ounces of buttermilk were taken in addition—the urine for the day =	78	1010	351

is admitted that there is much relating to absorption yet to be cleared up. It is in seeking to trace the "outflow" that we meet with difficulty. The present state of our knowledge does not permit of any definite statement being made regarding the early changes of metabolism. It is admitted by physiologists that we do not know the immediate precursors of urea. No urea is found in the muscles. It has been suggested that the amido-acids, leucin, glycin, and asparaginic acid are the forms in which nitrogen leaves the tissues, to be converted into urea in the liver. Bunge has shown, however, that there is not enough carbon in the proteids to convert their nitrogen into amido-acids. It has also been suggested by Bunge that Guanin ($C_5H_5N_5O$) Hypoxanthin ($C_5H_4N_4O$) Xanthin ($C_5H_4N_4O_2$) found in the liver, muscles, &c., are forms of broken down proteids on the way to form urea.

The *seat* of the change is, also, still unknown. Urea seems to be formed in the liver. No function, however, analogous to the glycogenic function, has been discovered. No urea is found in the liver,* but if carbonate of ammonia, or blood of an animal killed during digestion, be perfused through an excised but "surviving" liver, urea is formed. Uric acid has been proved to be formed in the liver of birds, and, in their case, uric acid is the chief end-product of proteid metabolism. In acute yellow atrophy, and in fatty degeneration of the liver, urea almost disappears in the urine, and is replaced by leucin and tyrosin.

There are good reasons, then, for believing that the liver is probably very largely concerned with the metabolism of the proteids and the formation of urea.

But urea is found in small quantities in the blood, so evidently *some* of the urea may only be separated by the kidneys from the blood. That this is the case is shown by the fact that less urea is found in the renal vein than in the renal artery. It has also been calculated, upon rough data, that the blood circulating at a given rate through the kidneys (say ten seconds) makes it possible that *all* the urea excreted may simply be separated in this way; and as urea accumulates in the kidney when blood is perfused, it is believed that urea may be formed in the kidney itself to a small extent. Without entering into further details or discussion of this complicated question, we may take the short sketch given above as an historical outline of the metabolism of the proteids, according to our present knowledge.

* Hoppe-Seiler.

I have shown that there is nothing deleterious in the food-stuffs used in the construction of the pauper diets. There is certainly nothing in the food-stuffs which would suggest an action upon the liver and an increased formation of urea, similar to the "Carbonate of Ammonia" experiment. The theory that carbonate of ammonia was a precursor of urea, has long been given up; and so we need not look for possible combinations of C, H, and N atoms derived from the food-stuffs, which might produce $(N H_4)_2 C O_3$ in excess and account for the increased urea in that way.* The proteid food offered in the diets, also, is *not* in excess, but rather the reverse; so that the theory of a *luxus consumption*, even if it were better established, does not enter into the discussion, as a possible cause of the increased urea. The diuretic action of the buttermilk is possibly a factor in the increase of urea in the inmates, in relation to what has been said as to the possibility of *all* the urea being separated by the kidneys. Stimulation of the kidneys would increase the action; but to assume that the buttermilk was the cause of the increased urea, would be to credit the buttermilk with a power not possessed by other diuretic agents; and moreover, it would necessitate the acceptance of the theory that the urea was a kidney *secretion*, while the balance of evidence is all in favour of the liver being the main seat of urea formation,—the kidneys only separating the already formed urea from the blood.

The experiments made upon J. F. and A. M'L. (cases Nos. XXXIV. and XXXV.) show that the substitution of skimmed milk for the buttermilk reduces the polyuria, and as a consequence of that reduction, there is less urea excreted.

In both these cases, the reduction of the "output" of urea, by the substitution of the skimmed milk for the buttermilk, was sufficient to place the individuals not only into a state of nitrogenous equilibrium, but to allow of a considerable *gain* in nitrogen.

Thus it appears that in some of the inmates, the mere withdrawal of the diuretic agent is sufficient to place them under normal conditions. This does not apply to all of them, however, and indeed, there are many who have buttermilk only once a day instead of twice, and some who are not upon buttermilk at all, who show a great loss of nitrogen in excess of the "intake." We have, therefore, to look further for a cause of the excessive excretion of urea.

* *Lactate of ammonia* has been suggested, as worthy of consideration, as a probable precursor of urea.

In healthy adults the "output" of nitrogen corresponds very nearly with the "intake." The nitrogen taken in the proteids is chiefly required to repair the waste of the nitrogenous tissues; and there is no nitrogen stored up in the organism, as is the case with compounds of carbon. In men and animals who have been starved, a rich nitrogenous diet with a sufficiency of fat and carbohydrates, will enable them to put on flesh, and for a time, the income exceeds the expenditure; but after a time, under normal conditions, the balance is struck and "nitrogenous equilibrium" is established. It is a well-known fact that the body-weight in healthy individuals remains the same, or nearly the same, over long periods of time. In healthy adults, *work* does not increase the excretion of nitrogen to any great extent, although hard labour is found to do so slightly. In growing children, the income is slightly in excess of the expenditure; and this suggests that in the down-grade of life, the contrary might be expected. *Age* may be mentioned, then, as a possible factor—although a very small one—in the increased excretion of nitrogen in paupers, as they are mostly up in years.

In reviewing the body-weights of the individuals upon whom the observations were made (see left hand corner of the charts) it will be noticed that the average body-weight of paupers is very low, especially when it is remembered to deduct 7 lbs. for clothing in the case of males, and 10 lbs. in the case of females. They are all ill-nourished and anæmic looking, although they may consider themselves, in relation to their mode of life, surroundings and other class distinctions, as being "in health." There is none that could be described as "healthy, well-nourished, muscular, well-developed, vigorous-looking or able-bodied." *They have no store of fat in their tissues, and this is the main and principal cause of the increased excretion of urea.* It is known physiologically, that when fat is given in fair quantity in a diet, that nitrogenous equilibrium is attained with a less quantity of proteid food. The inmates of the Poorhouse are "feeding" upon their own nitrogenous tissues, and the diets do not maintain them in "nitrogenous equilibrium." In starving dogs the excretion of urea diminishes gradually if the animal be fat; but in lean dogs the excretion of urea rises rapidly until a few days before death. The condition of the Poorhouse inmates seems to me to be analogous to that of the lean dogs of physiological experiment. Under normal circumstances, the fat and carbohydrates of the food taken, economise the proteids and protect them from over-hasty metabolism. Long before coming to the Poorhouse, this poor and ill-nourished class have oxidized their reserve store of fat and

carbohydrates, their energy having been converted into heat, or mechanical or chemical work. They are, therefore, in a state favourable to the breaking down of their nitrogenous tissues, and if we supply them with diets which are deficient in fat or carbohydrates, even although a sufficiency, or even an excess of proteids be offered, the nitrogenous equilibrium will not be maintained.

It is an accepted physiological law that *enduring* constancy of weight proves that the quantity of food taken corresponds to the needs of metabolism. Increase of weight proves that more food, and decrease of weight proves that less food, was taken than required by the metabolism. The body-weights recorded in these observations often do not appear to show a loss, which one would expect, in relation to the equivalent in *flesh* represented by the nitrogen excreted. Indeed, sometimes I have to record a slight gain, when a loss would seem more in conformity with the circumstances. Most of the weights at the beginning of the observations show only slight differences from the weights at the end of each month, and in individuals who show any remarkable difference I have offered explanations in the notes to the particular case. I should certainly expect, in the case of a well-developed muscular man —say of eleven stones, and his weight *not* due to fat, but to muscle—when placed in the same circumstances as the pauper as regards diet, and excreting nitrogen in excess—to show a very considerable loss in body-weight after a month. But in the case of persons considerably emaciated there are several factors—mechanical, personal, and physiological—which might produce differences, when these differences are slight in degree and only amount to a few pounds in most of the cases. I need not allude to the mechanical and personal sources of slight errors. They suggest themselves. I may mention, however, one possible physiological factor which may produce discrepancies in the body-weights, when compared with the gain or loss of *flesh*, indicated by the gain or loss of the nitrogen excreted. In this investigation, it would have been impracticable to include the estimation of the carbon and oxygen given off as carbonic acid by the lungs, and I have not followed the course and fate of the C, H, and O atoms, and their respective metabolites. Consequently, no "balance-sheet" of nutrition can be struck. The *total* income and expenditure cannot be compared, in relation to the body-weights, as some of the C, H, and O of the fats, carbohydrates, and proteids (in part) may have gone to produce fat or glycogen, some of which might temporarily be retained in the body. It is possible,

also, that short spells of "work" may account for some of the differences. Without increasing the nitrogen "output," the oxidation of the C, H, and O atoms may create a loss, when the nitrogen account suggests that he should have gained, and *vice versâ*. Again, it is known that "hard labour" in a normal healthy man only increases the nitrogen "output" very slightly; but "hard labour" is a relative term, and it is very different in the case of ill-nourished individuals not in a state of nitrogenous equilibrium, as witness the case of J. F. (case No. XXXIV., page 59) working hard on the invalid diet. The loss of nitrogen in his case is very great, amounting to an average of 10·7 grammes daily, as compared with only 3·1 grammes daily loss on the same diet, doing no work (see third experiment of five days, pages 60 and 62). Yet this man, excreting nitrogen in excess equivalent to 22 lbs. of flesh, shows only 2 lbs. of a loss in body-weight. I hesitate to strain the application of the foregoing suggestions to this case, so far as the discrepancies of body-weight are concerned. The body-weight of this man is very low, and there is no case recorded here of a man of fair body-weight losing so much nitrogen. There are apparently other unknown factors at work, such as occur in diabetes mellitus and insipidus, where large quantities of nitrogen are excreted, without, after a time, proportionate loss of body-weight. Unlike the diseased conditions, however, the current of urea excretion may be stemmed, in the case of J. F., by the simple substitution of skimmed milk for the buttermilk. (See second experiment on pages 60-62.)

So far, I may sum up regarding the causes of the abnormal conditions revealed by the observations.

The majority of the inmates of Poorhouses appear to be so ill-nourished as to be in a state analogous to the "lean dog" of physiological experiment. The store of fat is gone, and they are ready to feed upon their nitrogenous tissues, if allowed. The diets allow of their doing so, and being deficient in fat or carbohydrates, no protection is given to the proteid food, which, in itself, is sufficient to nourish individuals of such low body-weights. Their condition is aggravated, and sometimes—in the case of men who are not far short of nitrogenous equilibrium—actually *caused* by the defective construction of the diets. The polyuria arising from the "watery" character of the diets, and the diuretic action of the acid buttermilk, is a powerful factor concerned with the excessive excretion of urea. *Work* increases the excretion of urea considerably under these abnormal conditions, and the *body-weight* is a rough indication of the condition of the man,

and of how far he may be supposed to be from the normal state of "nitrogenous equilibrium" at the beginning of his case.

We are now prepared to review the charts in groups.

GROUP I. Contains the cases on No. 1 diet; and two men on No. 1 + beef diet.

GROUP II. Are all on the favourite "working" diet, No. 2 + beef. The females have been placed separately. The last male and the last female case, in this group, show the effects of changing the diet to No. 1 (male), and to No. 2 (female).

GROUP III. Contains those on No. 2 diet.

GROUP IV. Contains some irregular, and some "invalid" diets.

GROUP V. Contains six "experimental" diets (recorded later).

As the body-weight recorded in the left hand corner of each chart is to be taken as an index of the "condition" of the pauper, and as according to the theories already expressed the inmates who are better nourished ought not to lose so much nitrogen as those of the lower weights, I have arranged each member of a group in the order of the weights, beginning with the lowest weight, and ending with the highest.* Speaking generally, I think it will be found that the higher weighted inmate is nearer the normal state of nitrogenous equilibrium, and loses less nitrogen than the lower weighted man; but in observing this matter it is necessary to keep in mind the other, and often opposing factors, concerned with the abnormal condition present. A man may be of a better weight, but may be passing a greater amount of urine, and consequently there is an increased excretion of urea. Another man may be working fairly hard and imbibing much water, etc. In looking through these charts then, the points to be observed in relation to the increased urea excretion are:—

(1) The diet itself.
(2) The body-weight at beginning.
(3) The polyuria { watery diet. / buttermilk diet.
(4) The work done (if any).

NOTES ON THE FIVE GROUPS.

Group I. In this group there are eight men on No. 1 diet, and two on No. 1 + *beef*. I think it will be made out

* Sometimes, when the body-weights of different cases are nearly the same, I have considered the *height* in relation to their weights in the arrangement.

(although in this group it is not so apparent) that the total loss of nitrogen diminishes as the body-weight rises, always noting and allowing for the differences caused by the opposing elements (polyuria and work).

Cases I. and II. show loss, and their difference is due to the greater polyuria in Case I. Cases III. and IV. may be excluded, or the loss considered in relation to the short record of Case III., and the possibility already mentioned of his not taking all his food at first; while Case IV. has a heavier loss, due to "ague," which before the attack was in relation to the weight. Case V. shows slighter loss. Cases VI. and VII. are disturbed by great polyuria. Case VIII., the heaviest weight, shows a small gain. Case IX., a light weight, with no polyuria, shows a *gain* of nitrogen = 3½ lbs. *flesh*, while on beef and working. Case X., the last of the group, shows only a slight loss while on beef and working. In this last case, however, the polyuria is much greater than in Case IX. and accounts for the loss.

All the members of Group I. have lost body-weight except the heaviest weight (Case No. VIII.) and one light weight (Case No. IX.) who had beef as an extra, and had no polyuria.

Group II. (males). In this group the first two members—the lightest weights—show a loss of nitrogen, while of the last three members of the group, two show slight loss, and the heaviest weight a considerable gain. In the intermediate members, the third (Case No. XIII.), a slight gain is recorded, but there has only been in this case a moderate amount of urine passed. In the next case (Case No. XIV.) there is more loss—due to the urine averaging about 115 ounces daily. The next case (Case No. XV.) a slight gain is recorded, and here again the diminished urine explains the diminished excretion of urea. The next case (Case No. XVI.) shows a loss of nitrogen without any marked increase in the urinary secretion, and it appears to be due to "work." Almost all of the members of this group have lost slightly in body-weight. Case No. XV., showing a slight gain in nitrogen, also shows a considerable gain (8¼ lbs.) in body-weight. Case No. XVIII. shows a slight gain in weight, although a slight loss in nitrogen is recorded.

The last member of the group (Case No. XX.), is a special case, showing that for over three weeks he maintained his nitrogenous equilibrium on No. 2 with beef; but lost nitrogen the last week, when his diet was changed to No. 1. See the special notes in his case (page 40).

Group II.—continued (females). This group could not be so

closely observed as the members of the other groups. For this, and other reasons, it is not so satisfactory. The first case (No. XXI.) a light-weighted woman, an active worker, has evidently found the diet sufficient to allow of a gain of nitrogen, although the body-weight has not been maintained. The second case (No. XXII.) is incomplete; and the third and fourth cases show very considerable polyuria, and an excretion of urea so increased as to be quite out of proportion to the body-weights recorded at the end of the month. These cases have been specially noted, and the causes of the polyuria suggested (pages 43-45).

The last case (No. XXV.) is instructive, showing the effects of changing the diet. See special notes (page 46).

Group III. There are only three members in this group, and their charts may be viewed in the light of what has already been said of the previous groups. No. 2 is a diet which may be condemned on account of its poor nutritive value, and on account of the small quantity of iron present being insufficient for the physiological needs of the body.

Group IV. is composed of special cases, which having been already treated individually, require no further remarks by way of summary. I need only say that the diet of R. F. (Case No. XXXI.) is totally inadequate, and it also must be condemned for the same reason as that stated of the No. 2 diet—*i.e.*, deficiency in the amount of iron. Case XXXI. shows a great loss of nitrogen, not only because there is insufficient fat in the diet, but also on account of the nitrogen *taken*, being too small in amount. The case of J. S. (Case XXIX.) shows also a loss of nitrogen from the same reason, notwithstanding the diet being rich in fat. Case XXXI., with only 10·1 grammes nitrogen in the diet, loses more than Case XXIX. with 13·3 grammes; and as neither of these cases suffered from polyuria, they serve to indicate the lowest amounts of nitrogen that ought to be allowed in these diets—that is, not less, at all events, than 14 grammes.*

Special attention is called to the cases of J. F. and A. M'L. (Nos. XXXIV. and XXXV.) and their respective charts. The members of this group are not arranged—as the others—in order of their increasing body-weights.

* These cases seem to me to suggest, that in the treatment of gouty and rheumatic patients of stout and well-nourished bodies, the reduction of the N. *intake*, for a time (fixed by their previous normal *output*), would, *plus* diuretic agents, prove to be the readier way of reaching their nitrogenous tissues and favouring elimination. With *lean* individuals, on the other hand, the reduction of the *fat* in the diet would more quickly produce, as in the case of the Poorhouse inmates, an increased excretion of nitrogen.

GROUP V.

Experimental Diets.

NOTE.—*This group will be more readily understood if the reader first peruse the remarks on page* 85.

CASE XXXVI.

A. B. (male). Same man as A. B., Case No. I., page 18. The effects of No. 1 diet upon him being already recorded, A. B. was brought into the Hospital and placed upon a diet = porridge and buttermilk *twice* daily (breakfast and supper); dinner being bread, beef (4 ounces), and suet pudding (1 ounce suet; 3 ounces flour). Weight at beginning, 9 st. ¼ lb. No work. On the fifth day the beef was exchanged for the broth.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	90	1015	608
2	70	1020	455
3	65	1020	455
4	60	1017	270
5	70	1020	350
6	85	1015	382
7	95	1017	475
8	95	1015	475
9	90	1015	405
10	80	1017	560

Grammes N. taken =	70†	97·2†
GRAINS Urea excreted =	1788	2647
equals in GRAMMES .	115	171
equiv. to grammes N.	53	79
+ non-estimated .	4	6
+ lost in fæces . .	7	9
Total "Output" = .	64	94
Gain of grammes .	6 *gain.*	3·2 *gain.*

† These figures may be checked by a reference to the values of the diets, on pages 85-86.

Weight 10th day = 9 st. 2 lbs.

See Chart for Urine and Urea lines.

CASE XXXVII.

J. M. (male). Same man as J. M., Case No. XVII. (1) on No. 1 diet: (2) on porridge and buttermilk twice daily (breakfast and supper); dinner = bread, beef and suet pudding. (3) same diet as previous one, but beef exchanged for broth. Weight 10 st. 3 lbs. No work.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	70	1025	595	5	75	1012	300
2	75	1022	580	6	80	1014	400
3	70	1022	525	7	80	1015	440
4	80	1025	590	8	75	1018	525
Here he was placed on second diet.							
9	60	1020	390	11	47	1025	495
10	50	1020	500	12	40	1022	320
Here he was placed on third diet.							
13	40	1022	360	16	60	1022	480
14	50	1020	325	17	60	1018	420
15	55	1025	465	18	56	1015	462

Weight now 9 st. 12 lbs.

Grammes Nitrogen taken =	118·4	70	97·2
Grains Urea excreted =	3955	1705	2512
equals grammes	256	110	162
equiv. to Nitrogen	119	51	75
+ non-estimated by Hypobrom. =	9	4	6
+ lost in fæces	11	7	9
Total "Output" =	139	62	90
The difference =	20·6 *loss.*	8 *gain.*	7·2 *gain.*

See Chart for Urine and Urea lines.

CASE XXXVIII.

C. M. (male). Height 5 ft. 9 in. Weight 10 st. 12 lbs.; a slim-looking man; rises frequently at night, did not require to do so before coming to Poorhouse; does no work; observed in Hospital. Diet (1) No. 1 diet; (2) porridge and buttermilk twice daily; dinner = bread, beef and suet pudding; and (3) the broth substituted for the beef of previous diet. No Work.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	120	1015	540	5	120	1012	360
2	110	1016	495	6	120	1012	360
3	120	1015	450	7	115	1012	400
4	120	1012	360	8	120	1014	*420*

Here the second diet was given. Weight 10 st. 11 lbs.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
9	100	1015	400	11	95	1015	522
10	100	1017	500	12	70	1018	*420*

Here the third diet was given. Weight 11 st.

13	70	1017	385	16	150	1012	450
14	60	1012	255	17	140	1012	455
15	190	1020	850	18	100	1015	350

Weight now 11 st. 3 lbs.

Grammes Nitrogen taken = .	118·4	70	97·2
Grains Urea excreted = . .	3385	1842	2745
equals grammes . .	219	119	177
equiv. to Nitrogen . . .	102	55	82
+ non-estimated by Hypobrom. =	8	4	6
+ lost in fæces	11	7	9
Total "Output" = . . .	121	66	97
The difference =	2·6 *loss.*	4 *gain.*	0·2 *gain.*

See Chart for Urine and Urea lines.

CASE XXXIX.

A. H. (male). Same man as A. H., Case No. XII. *Working* as a Warder in the Hospital. (1) diet No 1; (2) porridge and *skimmed milk* twice daily; dinner = bread, beef and suet pudding; (3) The substitution of broth for beef, in the last diet. Weight 8 st. $10\frac{1}{4}$ lbs.

On Diet No. 1.—Working as a Warder.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	80	1022	590	9	70	1016	475
2	80	1006	200	10	70	1020	560
3	90	1010	450	11	80	1015	590
4	90	1018	540	12	80	1020	560
5	90	1017	495	13	80	1020	560
6	90	1020	810	14	75	1020	562
7	80	1020	640	15	78	1020	564
8	70	1015	420				

Here he was placed on the second diet. Weight 8 st. 9 lbs.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
16	60	1020	480	18	50	1020	475
17	55	1024	468	19	60	1020	480

Here he was placed on the third diet. Weight 8 st. 10½ lbs.

20	60	1020	480	23	60	1024	510
21	55	1022	495	24	60	1023	480
22	55	1025	550	25	55	1017	330

Weight now 8 st. 11½ lbs.

Grammes Nitrogen taken = .	222	76·4	106·8
Grains Urea excreted = . .	8016	1903	2845
equals grammes . .	519	123	184
equiv. to Nitrogen . . .	242	57	85
+ non-estimated by Hypobrom. =	19	4	.7
+ lost in fæces	22	7	9
Total "Output" = . . .	283	68	101
The difference =	61 *loss.*	8·4 *gain.*	5·8 *gain.*

See Chart for Urine and Urea lines.

CASE XL.

R. W. (male). Age 56. Height 5 ft. 6 in. Weight 9 st. 6 lbs. Been in ten days on No. 1 diet; labourer; frequently to rise at night and did not do so before coming to Poorhouse. Diets = (1) No. 1 diet; (2) porridge and *skimmed milk* twice daily; dinner = bread, beef, and suet pudding (1 ounce suet, 3 ounces flour); (3) broth given for beef in last diet.

Diet No. 1.—Weight 9 st. 6 lbs. *No* Work.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	90	1018	630	6	140	1014	840
2	95	1017	618	7	140	1013	700
3	100	1020	500	8	150	1012	675
4	135	1018	675	9	140	1012	720
5	130	1015	780	10	140	1015	755

Here he was placed on second diet. Weight 9 st. 1½ lbs.

11	75	1020	498	13	70	1022	455
12	70	1024	535	14	55	1020	440

Here he was placed on third diet. Weight 9 st. 3½ lbs.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grain Urea.
15	60	1023	390	18	90	1015	450
16	80	1020	460	19	90	1016	405
17	90	1015	450	20	80	1015	400

Weight now 9 st. 3 lbs.

Grammes Nitrogen taken = .	148	76·4	106·8
Grains Urea excreted = . . .	6893	1928	2555
equals Grammes . .	446	124	165
equiv. to Nitrogen . . .	208	57	77
+ non-estimated by Hypobrom. =	16	4	6
+ lost in fæces	14	7	9
Total "Output" = . . .	238	68	92
The difference =	90 *loss.*	8·4 *gain.*	14·8 *gain.*

See Chart for Urine and Urea lines.

CASE XLI.

R. M. (male). Same R. M., Case No. XVI. Working as a Warder in Hospital; placed on (1) No. 1 diet, then (2) supplied with the following diet, viz.:—porridge and *skimmed milk* (breakfast and supper). Bread, beef, and suet pudding (1 ounce suet, 3 ounces flour), and (3) the beef exchanged for broth. Working as a Warder. Weight at beginning = 10 st.

DIET No. 1.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
1	80	1015	420	6	100	1015	500
2	85	1020	638	7	110	1015	500
3	80	1018	520	8	100	1015	500
4	85	1019	595	9	110	1020	605
5	90	1015	585				

Here the *second* diet mentioned above was given.

Weight now 9 st. 11½ lbs.

10	60	1022	480	12	75	1020	525
11	60	1026	630	13	70	1020	455

Here the beef was exchanged for broth.

Weight 10 st. 2½ lbs.

Days.	Oz. Urine.	Sp. Gr.	Grains Urea.	Days.	Oz. Urine.	Sp. Gr.	Grains Urea.
14	60	1023	480	17	90	1015	450
15	80	1018	480	18	80	1015	400
16	80	1022	640	19	85	1017	425

Weight now = 10 st. 3 lbs.

Grammes Nitrogen taken = . .	133·2	76·4	106·8
Grains Urea excreted = . .	4863	2090	2875
equals Grammes . .	315	135	186
equiv. to Nitrogen	146	63	86
+ non-estimated by Hypobrom. =	11	5	7
+ lost in fæces	13	7	9
Total "Output" = . . .	170	75	102
The difference =	36·8 *loss.*	1·4 *gain.*	4·8 *gain.*

See Chart for Urine and Urea lines.

Group V. The members of this group are put upon a special diet, which I thought would serve to test the soundness of the theory, expressed in the foregoing pages, as to the cause of the disturbance of the nitrogenous equilibrium. It will be noticed that all are placed, *first*, for some time on No. 1 diet. A. B.'s case does not show this, because the effects of No. 1 diet upon him are already recorded (see Chart, and Case No. I., page 18). It is seen that on No. 1 diet, all the six cases *lose* nitrogen, in varying proportions, according to body-weight, and the amount of polyuria present. I may here repeat, for convenient comparison, that the value of No. 1 diet =

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes . .	83·5	17·3	333·8	=	14·8	194·2

The dinner of all six cases is now altered thus: the broth is withdrawn, and 4 ounces of beef (which includes the usual amount of fat, viz., 1 ounce) and suet pudding (composed of 1 ounce of fat, and 3 ounces of flour), are given for the broth. The effect of this is to "dry" the diet by the withdrawal of about 30 ounces of water (broth). It supplies also an increased quantity of *fat*, and carbohydrates—the value of this diet being:—

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes . .	97·5	76·4	341·8	=	17·5	251·2

The first *three* members of the group are kept upon the buttermilk throughout; but the remaining *three* are allowed the same quantity of skimmed milk, which alters the value to :—

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes .	107·7	84·5	358·8	=	19·1	258·4

It will be observed in the charts of all the six cases that in the second experiment of four days the secretion of urine falls (black line) due, of course, to the drier diet. Those on skimmed milk show a greater and more rapid fall than the men on the buttermilk.

In all six cases the nitrogenous equilibrium is restored, and all show a *gain* of nitrogen, the four lighter weights *keeping* more nitrogen (Cases XXXVI., XXXVII., XXXIX., XL.) than the two heavier men (Cases XXXVIII., XLI.), who may be supposed to be in better condition, and not requiring so much nitrogen to restore their nitrogenous tissues. It may be pointed out, also, that while the urea (red line) falls more or less in the four light weights, along with the urine (black line) it does not do so in the cases of the two heavier weights. In the latter cases, the greater average amount of urea excreted is the excess of nitrogen not required, and which is given in the richer diet.

In the third experiment of *six* days, the broth was allowed for the beef. This reduces the fat materially, but increases the carbohydrates. The water in the diet is increased now by about 30 ounces. In the three cases of the first division of the group (*on buttermilk*) the value of the diet is now :—

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes .	90·3	46·8	390·7	=	16·2	245·2

while the second division, *i.e.*, those on *skimmed milk* =

99·8	54·9	407·7	=	17·8	252·4

The effect of the change of diet, upon the chart lines, is to raise the black (urine) line, as would be expected by the increase of water in the diet; while still in *all* the six cases the fat in the diet is sufficient for the protection of the proteids, and allows of the organism preserving its nitrogenous equilibrium. The body-weights all show a loss while on No. 1 diet, but rapid and considerable gains in the few days the men are on the richer diets. The results show that it is unnecessary to give so much fat, as in the second experiment; and that there is sufficient fat in the third experiment to preserve the

nitrogenous equilibrium, even in the case of those on the buttermilk, which has been shown (in previous groups) to be a powerful factor in the causation of the increased urea excretion.

This group will be again referred to in the concluding section of this work, in relation to the improvement and correction of the diets. In the meantime it is desirable to consider here the second section.

II. The Iron in the Diets in Relation to the Anæmia present in the Inmates.

This branch of the subject has not been found to be so important in results as was at first expected when I began the analyses to determine the amount of iron in the diets. The information derived from the examination of the blood may therefore be very briefly considered.

In my introductory remarks, I have observed that in acute starvation the blood may show apparent concentration, but that in chronically ill-nourished people no such concentration takes place. In no case has the specific gravity of the blood of any pauper examined exceeded 1,059, and it is more probable that had the exact specific gravity been taken, many would have shown a decrease. The records of the blood examined will serve, along with the body-weights, to indicate the measure of the ill-nourished condition of the inmates of the Poorhouse, as no selection has been made, every pauper's case, once started, being completed, so long as his residence in the Poorhouse permitted of its being done.

In experiments made upon starving animals it has been found that the animal dies when it loses from 25 to 50 per cent. of its body-weight. The organs of the body suffer in a definite order—the fat, muscle, liver, and spleen being affected early, while the heart and brain are the last to fail. If a diagram be constructed of the percentage loss of weight of each organ—calculated on its original weight by comparison with the organs of a similar animal killed in good condition—it is found that the blood is not affected until there has been, more or less, loss of fat, muscle, liver, and spleen. The state of the blood examined in these cases will therefore be an indication of how far the paupers may be on the downward grade. If the male inmates in Group I. and II., viz., all those on No. 1 diet, No. 1 + beef, and No. 2 + beef, be considered together, the average number of red blood corpuscles per cub. mm., at the beginning of

the observation, is found to be about 4,450,000; and at the end of the observation, after living upon the diets in question for periods of a month, or longer, the average number per cub. mm. is about 4,590,000. There is thus, apparently, a slight improvement so far as the number of corpuscles is concerned.

The same cannot be said of the hæmoglobin; for if the same cases be reckoned in the same way, 69 per cent. is the average amount of hæmoglobin present at the beginning, and 61 per cent. the average at the end of the observation.

According to the most recent literature upon the subject, the quantity of iron in a daily diet necessary to meet the physiological needs of the body is from 6 to 10 milligrammes. In the two diets I have analysed—No. 1 and No. 2 diets—there were 9 milligrammes in the former and only 5 milligrammes in the latter diet. As the inmates from whose cases I have struck the average are all on No. 1, No. 1 with beef, or No. 2 with beef, it cannot be said that these diets contain an insufficient quantity of iron. No. 2 diet does not contain a sufficient quantity of iron, and it may on that account alone be condemned; but when beef is allowed in addition, the amount of iron in the diet is brought within the normal figures. It would appear, then, that although the diets mentioned above contain a sufficiency of iron to meet the needs of normal individuals, yet the diets are inadequate to restore the blood to the normal condition in people who are ill-nourished, and whose blood has already deteriorated to the extent indicated in the Cases. This line of argument is strengthened by the fact that many of the inmates appear to show for a time a slight improvement in the percentage of hæmoglobin, as well as in the number of corpuscles—an improvement, however, which, on taking the average results, is not maintained.

It is probable, then, that were the defects in the ordinary Poorhouse diets corrected, that the amount of iron in the diets would not constitute a fault which would require any special attention; for once the other abnormal conditions were rectified, the diets would be sufficient to preserve the inmates in health, and the blood would participate in the benefits which the other organs and tissues derived from the change, as, under normal conditions, the amount of iron in the diets is sufficient for the physiological needs of the body. This does not apply to No. 2 diet, or to the diet of R. F. (case No. XXXI.), which allows of tea twice daily, both of which must be condemned on account of the analysis proving that the one (and consequently the other) is quite deficient in iron.

III. Consideration of the Poorhouse Diets—their Relations and their Defects—and how far these may be Improved and Corrected.

In dealing with the body-weights in a previous section of this work, I have stated that *enduring* constancy of weight is admitted to be a sign that the quantity of nourishment taken and absorbed corresponds with the needs of metabolism. In the cases of the inmates of the Poorhouse that have been included in these observations, it cannot be said that the ordinary diets are sufficient to maintain weight. The inmates on No. 1 diet *all* lose but one; on No. 2 diet, and on No. 2 with beef, two-thirds lose; on No. 1 diet with beef, there are only two cases recorded, of which one gains and the other loses weight—the loss being greater than the gain. The average weight of the male paupers examined is 9 st. 9 lbs., which, less 7 lbs. for clothes = 9 st. 2 lbs. In the case of females, the average weight is 7 st. 8 lbs., less 10 lbs. for clothes = 6 st. 12 lbs. These cannot be deemed normal weights.

The cases must be separately considered in relation to their heights; but, speaking generally, the weights of by far the majority of the inmates are out of relation, and very much lower than they ought to be. The average height of the males runs about 5 ft. 5½ inches, and that of the females, 5 ft. 2-3 inches. The weights of normal, healthy persons of these heights should not be less than 10 to 11 stones in males; and about 8 to 9 stones in females.

It is now an accepted fact in physiology, that the daily value of a normal diet should be between 35 and 50 calories for every kilogramme of body-weight—the variations being required to meet different occupations entailing more or less physical labour. These figures apply to all—the differences between the diets of the rich and the poor lying more in the daintiness of the food, than in the value of calories. According to Von Noorden, the daily metabolism of a person moving about freely and performing light work, is 15 to 20 per cent. higher than that of a person at absolute rest (in bed). In the case of labourers accustomed to toil, the difference is much greater, and may be from 40 to 60 per cent., or even higher.

He has found, with only a very few exceptions, that patients in bed, not suffering from any special diseases which would interfere with the estimation, required *at the least* a diet of the daily value of 32 calories for each kilogramme of weight. The average estimate then of a diet suitable for persons moving

about freely, and doing very light work, such as lending a hand in the wards, is placed at 38 calories per kilogramme of body-weight; and this figure Von Noorden considers the very lowest that may be allowed, if it be desired to maintain the body-weight.

If the table of diets (page 13) be now referred to, the value of the five pauper diets will be seen. These are for

No. 1 Diet	1871·6 Calories.
No. 1 Diet + Beef . . .	2232·0 ,,
No. 2 Diet + Beef . . .	2105·7 ,,
No. 2 Diet	1745·3 ,,
Invalid Diet (in bed) . .	1872·5 ,,

If the calories of the different diets be divided by 38, we shall get the body-weights which these diets are deemed sufficient to maintain—setting aside, at present, all consideration of *constructive* defects in the diets, which might interfere with the nutritive values.

Diet.	Kilos.		St.	Lbs.
No. 1 is sufficient to maintain a weight of about . . .	49	= about	7	7
No. 1 + Beef is sufficient to maintain a weight of about . . .	58	= ,,	9	6
No. 2 + Beef is sufficient to maintain a weight of about . . .	55	= ,,	8	9
No. 2 is sufficient to maintain a weight of about . . .	46	= ,,	7	3

The calories of the "invalid" diet, divided by 32, gives the value of the diet as sufficient for a weight of 9 st. 1 lb.

As the diets in the Poorhouse must be uniform, for all members of each class, and as the average weight of male paupers is 9 st. 2 lbs., it would appear, that so far as mere nutritive value is concerned, Diet No. 1 with beef, *i.e.*, the ordinary working pauper's diet, is suitable for males, and Diet No. 2 with beef suitable for females (and rather too low for males)—provided the work done by these inmates was of the most *trifling* description. It is clearly manifest, however, that the Local Government Board Rules intend the Diets Nos. 1 and 2 with beef to be "working" diets—such work as that done by warders, cleaners, wood-choppers, sawers, "bunchers of wood," &c.

The Diets Nos. 1 and 2 (no beef) are for the "non-workers,"

but this term is a relative one. These non-workers all have to tease a little hair or oakum, and help in very "light jobs." This class, then, corresponds to Von Noorden's "persons who move about freely, doing very light work, such as lending a hand in the Ward," and for whom the minimum value of the diet allowed, is 38 calories per kilogramme of body-weight. Therefore the Diets No. 1 and No. 2 are too low for the non-workers; and so also are the working Diets No. 1 + beef, and No. 2 + beef, for the real workers, in relation to the harder work. Moreover, we have taken the average weight of the paupers from the actual figures of the cases themselves, and these cannot be deemed to be normal weights—the inmates being light-weighted owing to their ill-nourished condition. Persons who have suffered from a protracted period of defective nutrition, may show a diminution in the amount of material waste, and it has been thought (Klemperer) that individuals suffering from general marasmus required less food, in consequence of this smaller "output." It was also at one time believed that in anæmic conditions there was less oxidation, and hence it was wrong to burden the organism with a diet which could not be assimilated. Both doctrines have been proved to be fallacious; and it has not been proved that the metabolism of emaciated persons has sunk to a lower rate, or level, than the normal. A glance at the weights of the last four cases recorded (those placed upon the richer diet, Group V., where the weights have been taken at the end of each short observation) shows how quickly the body-weights begin to improve when the organism gets the chance of more nourishment.

It should not be the body-weights as they are, but rather, what (approximately) the weights ought to be, that should regulate the nutritive value of the diets given; and hence if 10 to 11 stones be the proper weight for a man of 5 feet $5\frac{1}{2}$ inches, and 38 calories per kilogramme of body-weight be the minimum daily value necessary for his support, the calories (taking 66 kilogrammes as the average weight) should be about 2500 for a man doing little or very light work. Practically, it has been found that sometimes the diet may be slightly less than the physiological limit of a normal diet. It is quite clear, however, that diets No. 1 and No. 2 are too low for men moving about and even doing very little that could be called "work"; for even if the total calories of these two diets be divided by 32—which is the minimum calories for each kilogramme of body-weight for persons at *absolute rest in bed*—they still show that they are both deficient. The figures are:—

		Calories.			Kilos.		St. Lbs.
Diet	No. 1 =	1871·6	÷ 32	= about	58½	= about	8 6
,,	No. 2 =	1745·3	÷ 32	= about	57½	= about	8 3

That is to say, that the two non-working paupers' diets are only sufficient in nutritive value to support men of 8 st. 6 lbs. and 8 st. 3 lbs. respectively, while in a state of absolute rest in bed. Consequently, as the average weight of paupers is higher (9 st. 2 lbs.)—even allowing that their weights are normal weights, and not those of ill-nourished men—the two non-working diets are too low for men moving about and doing light work. The proper nutritive value of a diet sufficient to support a man of 9 st. 2 lbs. (say 60 kilogrammes) should be about 2280 calories.

The two "working" diets, once re-constructed, and slightly improved in value, would be sufficient, speaking practically—with the objects of the poorhouse relief in view, and with the knowledge of how much work is done. Probably, there are some who work well and should have a slightly better diet, and others who are fed well enough. The inmates are not pressed to work if deemed unfit. Pressure is only brought to bear upon exceptional cases who appear to be "able-bodied," and who have no right to seek poorhouse relief.

It is much more important to settle the values of the two lowest non-working poorhouse diets. They should not be less than the lowest nutritive values known to be sufficient to maintain in health men in a state of "rest," and they should not exceed 38 calories daily per kilogramme of body-weight. Practically, the diets at present in use have been found to serve their purpose, without any apparent urgent evils calling for prompt remedies. The complaints have not been numerous nor clamant, and it is only after a lengthy and systematic investigation that defects have been revealed.

The table of the diets (page 13) shows the relations of the pauper diets to other public, and to physiological diets. It is interesting to note, that while Pettenkofer and Voit's diet for labourers at work, for a man of 70 kilogrammes (about 11 st.), gives 50 calories per kilogramme of body-weight, the diet for labourers of the same weight *at rest* corresponds very nearly with Von Noorden's estimation, and = 38 calories for each kilogramme.

The diets used in the Calton Prison should also be noticed, and the relations of the paupers' diets to the prisoners' diets. I have called the prisoners' diet a "light work" diet, but practically the work done by the prisoners does not differ much

from that of the so-called non-working paupers. Moreover, the prisoners' diets are increased after a time, which is not the case with the diets of the paupers, which remain always the same, unless a slight change is granted as a favour. I can see no reason why the pauper class should not be placed upon as good terms, as regards their diets, as the criminal class. Indeed I should imagine that they ought to be slightly better; so that in relation to the public dietaries quoted, as well as upon good and well-founded physiology, I should seek, while suggesting the remedies to meet the defective construction of the pauper diets, to likewise remedy their nutritive values, all of which should be more or less increased.

The Buttermilk.

This article of dietary may be a very pleasant beverage, for occasional use, to the few people who appear to be fond of it. I can only say that it is much disliked by the paupers who are compelled to partake of it as a regular and constant accompaniment to their porridge, once, and more frequently twice, daily. There are many of the inmates of the Poorhouse, who are deserving—on account of age or conduct—of some consideration in this respect, and many of these cases *are* relieved; but generally it is done by the substitution of a bread and tea diet, which has not the equivalent nutritive value of the porridge diet, which they would otherwise enjoy, were it not for the unpleasant buttermilk. In other cases, the acidity, eructation, and often vomiting, which the buttermilk produces, necessitates its withdrawal.

The nutritive value of buttermilk is very low, containing only a percentage of 2·4 proteids, ·026 fat, and 2·3 carbohydrates. It is a powerful diuretic, as may be seen by a consideration of the cases here collected, the buttermilk being responsible for about 15 per cent. of the diuresis excited by the pauper diets. (See again the cases of J. F. and A. M'L., pages 59 and 63). As a consequence of the polyuria excited, it is also a factor in the production of the increased urea excretion present in such a large proportion of the inmates.

I think that these are sufficient reasons why buttermilk should be discarded wholly, or almost wholly, from the Poorhouse dietaries. I say *almost* wholly, for I would still reserve it in the diets of those who make use of the Poorhouse as a sort of "Pauper Hydropathic." These paupers come in so frequently, suffering from the effects of alcoholic excesses, and go out in the course of a few days so

much the better of their short visit, that I fail to see what harm the present No. 1 diet can do them; and it certainly would only be an encouragement for them to re-enter the Poorhouse much more readily, if they were dieted upon more generous lines. The diuretic effect of the diets upon alcoholic cases can only be productive of benefit, and I would therefore retain the buttermilk diets for such cases; and for those, even not alcoholic, who belong to the vagrant class, who only enter the Poorhouse for a few days, when at their last extremity, for repairs. So far, I can conscientiously yield to the parochial necessities, and I would recommend that the buttermilk diet be retained as a preliminary or "entrance" diet, which might be continued for one, or even two, months, without much harm, and in many cases with distinct benefit to the individuals. After that time I should consider that the pauper had given the parochial authorities an additional reason for believing that he was utterly without hope, for a time at least, of making his way in the world and living by his own exertions. He should then be allowed a better diet, and it is always in the power of the parochial authorities to request the medical officer to give an opinion upon his case, as to his fitness for ejection from the Poorhouse as "able-bodied,"—a condition more likely to be produced by a better diet. By thus better fitting the man for work outside, perhaps the result would be a truer economy to the parish, than by keeping him for a longer period in a half-nourished condition.

There is a large number of paupers who, from their age, or nature of their infirmities, remain for months and years resident in the Poorhouse. Their cases are utterly hopeless, so far as any intention, or possibility, of their ever finding other means than parochial of maintaining themselves. It is more particularly for this class that an improvement in the diets is called for. It is, in fact, in *all* cases—but the class of temporary paupers and vagrants which I have just referred to above—that I would suggest the substitution of skimmed milk for the buttermilk. In many cases (as I have shown in Cases No. XXXIV. and XXXV.) this simple improvement would serve to stem the current of nitrogenous waste which the pauper diets produce in individuals who are ill-nourished from long-continued destitution and poverty. In all the cases experimented upon, the result of the change has been to restore the nitrogenous equilibrium, and to allow of a distinct gain of nitrogen equivalent to a considerable gain of "flesh."

The change would go far, too, in raising the nutritive value

of diet No. 1, as the value of the diet, with skimmed milk instead of buttermilk, would be, in calories, 2058·5, which is somewhat nearer the value, which I have already mentioned, as that required—upon the lowest estimate—for a man of about 9 st. 2 lbs. If 2058·5 calories be divided by 60 kilos. (about 9 st. 2 lbs.) the result shows the value to be equal to about 34⅓ calories per kilogramme of body-weight; and as 32 calories per kilogramme is admitted to be the very lowest necessary for a man in a state of *absolute* rest in bed, it may surely be acknowledged that this small increase of value is certainly not in excess of the requirements of paupers moving about freely and doing light work.

The change would also allow of many of the inmates—at present on a bread and tea diet in consequence of their dislike to buttermilk—returning to the more nutritive porridge diets. No. 2 diet—the tea diet referred to—is not an official diet. It is simply the result of tea being allowed for porridge at night—as a favour. It is a diet of very low value, and should be condemned as being not only deficient in *nutritive* value, but also lacking in the necessary quantity of iron requisite in every normal diet.

The value of this diet (No. 2), if ¾ pint of skimmed milk be substituted for the buttermilk, is:

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes	74·8	17·9	333	=	13	189·1

which in total calories = 1838·3. As this, to a man of 9 st. 2 lbs., would only yield him 30½ calories per kilogramme of weight, No. 2 diet is still far below a sufficiency; and if this form of diet is to be continued—as it must be, so long as tea is allowed—it should always be associated with some extra. *No. 2 with beef* is a working diet, the value of which, with the skimmed milk as above, would be 2198·5 calories. No. 1 with beef, and skimmed milk as above, would have the value of 2418·7 calories.

The values of the four diets with buttermilk may now be compared with the values of the same diets when skimmed milk is given—in the same quantities:—

Diets.		With buttermilk. Calories.	With skimmed milk. Calories.	
No. 1 . .	=	1871·6	2058·5	Non-workers or "Light Workers."
No. 2 . .	=	1745·3	1838·3	
No. 1 + beef	=	2232·0	2418·7	Workers.
No. 2 + beef	=	2105·7	2198·5	

I would ask those interested in the respective nutritive values of the pauper diets to consider these figures. A kilogramme is equal to (very nearly) 2 lbs. 3¼ ounces. If the body-weights of the paupers be converted into kilogrammes, and the calories be divided by the weights (in kilos.), the quotients will show the number of calories given, daily, per kilogramme of weight. The average weight of the paupers = 9 st. 2 lbs. (about 60 kilos.). The lowest values for each person, that should be given, are 32 calories daily, per kilogramme of body-weight for individuals at absolute rest in bed; and 38 calories, per kilogramme, for persons doing very light work. More should be allowed when the work done is such work as "warders in the Hospital, sawers, bunchers of wood, &c., &c." Again, if it be desired to know the body-weights, which the total calories (tabled above) are sufficient to maintain, it is only necessary to divide by the figures 32 or 38, &c.

My own opinion is—and I give it with a full sense of the importance of the principle that these diets must not be raised above the level of the lowest labouring class—that the nutritive value of a non-working pauper's diet—*i.e.*, one not in bed, but moving about freely and doing the very light "work" (?) which the class is expected to do, should not be less than 35 or 36 calories daily, per kilogramme of body-weight; and for good workers, probably 40 to 42 calories per kilogramme would be sufficient. The amount of work done by the pauper will probably correspond with his feeling of "fitness," and it is probable that he will do rather less than more. It is the fixing of the *lowest non-working diet* that I consider the most important and the most responsible duty. The substitution of skimmed milk for buttermilk will go far to remedy the evils which exist in the vast majority of the cases, as I have pointed out in the section dealing with the abnormal conditions found. The polyuria will be diminished, and as a consequence of this, as well as from the increased nutritive value of the diets, there will be decreased excretion of urea, and less waste of the nitrogenous tissues. In many of the cases the nitrogenous equilibrium will be restored, but not in all; and as the figures still show that the nutritive values are below the mark, I would go a little further.

It will save repetition if I draw attention once more to Group V. of the observations, and very briefly point out the objects of these experiments. I have already expressed my opinion as to the causation of the increased urea excretion, and have considered the various factors concerned in its production. The starting-point lies in the ill-nourished condition of the pauper,

and by supplying him with an increased quantity of fat, I hoped to see the proteid part of the diet protected, and retained within the organism. The result will be observed to be that with the substitution of beef and suet pudding for the broth, the nitrogenous equilibrium is at once restored, and all the members of the Group keep nitrogen and gain weight. I then withdrew the beef and allowed the broth, still continuing the suet pudding. It will be noticed on the charts that they all still keep nitrogen, although somewhat less (one case keeps more), and they all, at least, *maintain* their weight. I have mentioned the "watery" character of the diets as a factor in the causation of the increased urea excretion. It is only so when the other elements mentioned have already established the condition. A "watery" diet then, such as these porridge diets must continue to be, is not in itself injurious, so long as the other factors concerned in the disturbance of the nitrogenous equilibrium are absent.

The experiments show the amount of fat and carbohydrates necessary to preserve the nitrogenous equilibrium in persons of the pauper class. It is not necessary to give both beef and pudding for this object, but it is satisfactory to see a gain in weight in individuals who very much need it. Had the experiment been continued for a month I am sure the members of Group V. would have presented a great improvement in their general appearance and physique. They all would probably have gained more than a stone in weight. The diets of the experimental group, however, are too rich. The beef and suet pudding dinner, and skimmed milk with the porridge, works out, for a man of 60 kilogrammes, to the value of 45 calories per kilogramme of weight.

The value of the suet pudding (which contains one ounce suet, and three ounces flour) is :—

	Proteids.	Fat.	Carbo-hydrates.		Nitrogen.	Carbon.
Grammes .	10	29·6	58·8	=	1·9	53·8

and this yields a value of 557·2 calories. If this suet pudding were given to the non-working inmates on No. 1 diet, after their broth, *twice* weekly, we should add to the value of No. 1 diet a daily average of 159·2 calories. This would bring the value of No. 1 diet with *skimmed milk* to the daily average of 2217·7 calories, which is still slightly below the figure (2280) deemed the lowest necessary for a man of 9 st. 2 lbs. moving about, doing very light work. This value of No. 1 diet, with skimmed milk + suet pudding twice weekly, is equivalent to 36¾ calories daily, per kilogramme of weight.

If it be desired to place the real "working" diets upon the same plane, the good workers would require to get the suet pudding also twice weekly—the value of No. 1 diet, with skimmed milk, beef and suet pudding, the latter only twice weekly, would be (average daily) 2577·9 calories, which is equivalent to about 42 calories per kilogramme of weight.

I much prefer, in recommending these changes, that the increased fat be given in the form of a pudding made with flour. To increase the fat by giving more beef would be to increase the proteids in place of the carbohydrates. This would be to increase the "intake" of nitrogen, which is not desirable. It is useless to offer more nitrogen if the organism cannot keep it, and to keep the nitrogen already offered, and which I consider quite sufficient, it is necessary to increase the fat and *carbohydrates.* This is done by means of suet pudding. So long as we are dealing with individuals of small muscular bulk, a smaller quantity of nitrogenous food suffices, as only a daily, moderate supply is wanted to nourish the little nitrogenous tissue they possess.

To sum up this part of my subject, then, I recommend (1) that skimmed milk be substituted for buttermilk in all the "permanent" diets used in the Poorhouse. I consider this change imperatively called for, in relation to the polyuria, and abnormal "output" of nitrogen which, in the vast majority of the cases, is in great excess of the "intake"; (2) that, twice weekly, or oftener if a less quantity be used, suet pudding be given to all permanent residents in the poorhouse on No. 1 diet (light or "non-working"), to bring up the average nutritive value of the diet to the proper number of calories; (3) that No. 2 diet (now with skimmed milk in place of the buttermilk) being defective in nutritive value, should never be given alone, but with beef as an extra—individuals on this diet (being a tea diet) have even more need of the suet pudding, twice weekly, than the inmates on No. 1 diet; (4) I would retain the present No. 1 buttermilk diet, as an "entrance" diet for the temporary cases, this diet not to be continued longer than two months; (5) the "fish" and "potato" dinners referred to in the section upon the diets (page 10) may be recommended on the grounds of *agreeable change.* I have not discussed them beyond stating the value of the potato dinner (page 12), as they may be allowed according to the Local Government Board Rules at present, and it is a question which may be left to the discretion of Parish Councils.

The Cost of the Proposed Changes.

The quantity of buttermilk used in the two Edinburgh Poorhouses, averages about 22,000 gallons in the year, at 3d. per gallon. The price of skimmed milk is 4½d. per gallon. Supposing that the substitution of skimmed milk for buttermilk were complete, and also that contracts could not be made on cheaper terms, 22,000 gallons × 1½d. (the difference in the price of the skimmed milk and buttermilk) would be equal to an increase in the expense of the diet to £137, 10s. I understand that this would increase the rate in such a city as Edinburgh just 0·0016 of a penny.

But it is not proposed to abolish the buttermilk altogether. It is still suggested that it be used in an "entrance" diet. The percentage of these "temporary" paupers has been estimated to be about 75, so that probably much less than half of the sum mentioned above would be sufficient to meet the expense of the very necessary improvement.

Should the second suggestion be adopted, and suet pudding be given to the inmates who are permanent residents in the Poorhouse, the cost may be reckoned in the following manner.

The average total number of paupers in the two Edinburgh Poorhouses is 924. If *all* these were allowed suet pudding twice weekly, and each suet pudding contained 1 ounce of suet and 3 ounces of flour, 924 ounces of suet and 2772 ounces of flour would be required for each dinner. There would be 104 such; and when these figures are multiplied, and the results reduced, the amount of each article required yearly is 6,006 lbs. suet, and slightly over 64 sacks of flour (280 lbs. each). The price of the suet is 4d. per lb. which = £100 2s.
and 64 sacks flour at 22s. . . . . = 70 8s.

price of suet pudding in the year . . = £170, 10s.

The total cost of the two changes proposed would be £308 per annum if every pauper in the two Poorhouses were allowed skimmed milk and suet pudding; but a reference to the Poorhouse Register shows that a very large percentage of the Poor only come in for very short periods of time, and to them the "entrance" diet would apply. The total cost, therefore, would be probably less than half of the sum estimated, and this would only put a very small fraction of a penny on the rates.

SUMMARY.

(1) The necessity of an inquiry into the Dietary of Scottish Poorhouses was suggested by the anæmic condition of the paupers, and the frequent complaint of increased micturition.

(2) The observations reveal that the inmates living upon these diets suffer from a mild form of polyuria, 15% of which is due to the buttermilk, and the remainder to the "watery" character of the diets.

(3) Along with the polyuria, there is increased urea excretion, which upsets the "nitrogenous equilibrium" of the inmates.

(4) The "output" of nitrogen is greater in the case of inmates who are of low body-weight, and less well-nourished. The better nourished, heavier men, do not lose so much. To appreciate this fact, all the factors tending to increase or diminish the abnormal conditions must be noticed.

(5) The watery character of the diets, and the diuretic action of the lactose in the buttermilk, while they are not in themselves the cause of the increased urea excretion, are yet very powerful factors in its production.

(6) The true cause of the increased urea excretion is the absence of fat in the organism not allowing of any protection to the proteids, and the fat and carbohydrates in the diets being insufficient to supply their needs—hence the inmates "feed" upon their nitrogenous tissues.

(7) The diets are insufficient to maintain the body-weights of by far the largest proportion of the inmates.

(8) "Work" increases the output of nitrogen in the case of persons not in a state of nitrogenous equilibrium, while it does not do so materially in normal persons.

(9) In estimating the effects of these diets, it is necessary to remember all the factors in the causation of the abnormal conditions, *viz.*, the diet, body-weight, polyuria, and work.

(10) The lowest physiological value that may be allowed for men at absolute rest is 32 calories for each kilogramme of weight; and for men moving about doing very light work, 38 calories.

(11) On these scales, all the diets are too low.

(12) The estimation of the necessary value of a diet ought to be made for *normal* weights. The paupers' weights are subnormal; but even accepting these weights, the diets are too low.

I estimate the lowest value of a diet for a pauper (not working)* at 35 or 36 calories per kilogramme of body-weight; and "workers" at 42 calories per kilogramme.

(13) The paupers' diets are less in value than the diets of the criminals in Calton Prison.

(14) The analyses of the diets to determine the amount of iron, were made with a view of discovering how far the diets were responsible for the anæmia present. The observations show that it is possible for the number of red blood corpuscles to increase in inmates living upon these diets. The hæmoglobin percentage is much below the normal and does *not* improve. No. 2 diet is shown to have too little iron. The other diets contain sufficient iron, and if their nutritive values were raised, and their defects corrected, there is sufficient iron in the diets to meet the physiological needs of the body.

(15) The substitution of skimmed milk for the buttermilk would go far towards correcting the abnormal conditions, and would also raise the nutritive value of the diets. It would also obviate the necessity of giving tea diets to the males—tea diets being always lower in nutritive value.

(16) The addition of suet pudding (one ounce suet and three ounces of flour) twice weekly, would almost raise the nutritive values of the diets to the standard required by modern physiology. In suggesting this change, I have kept in mind the great importance of not increasing the value of the paupers' diets unnecessarily.

(17) I advocate the use of the buttermilk diet for a limited time as an "entrance" diet for "temporary cases" of the vagrant type.

(18) The cost of the changes is so inconsiderable, in relation to the rates, that it can hardly be said to affect them.

* So-called; but better expressed "very light working."

CASE No1

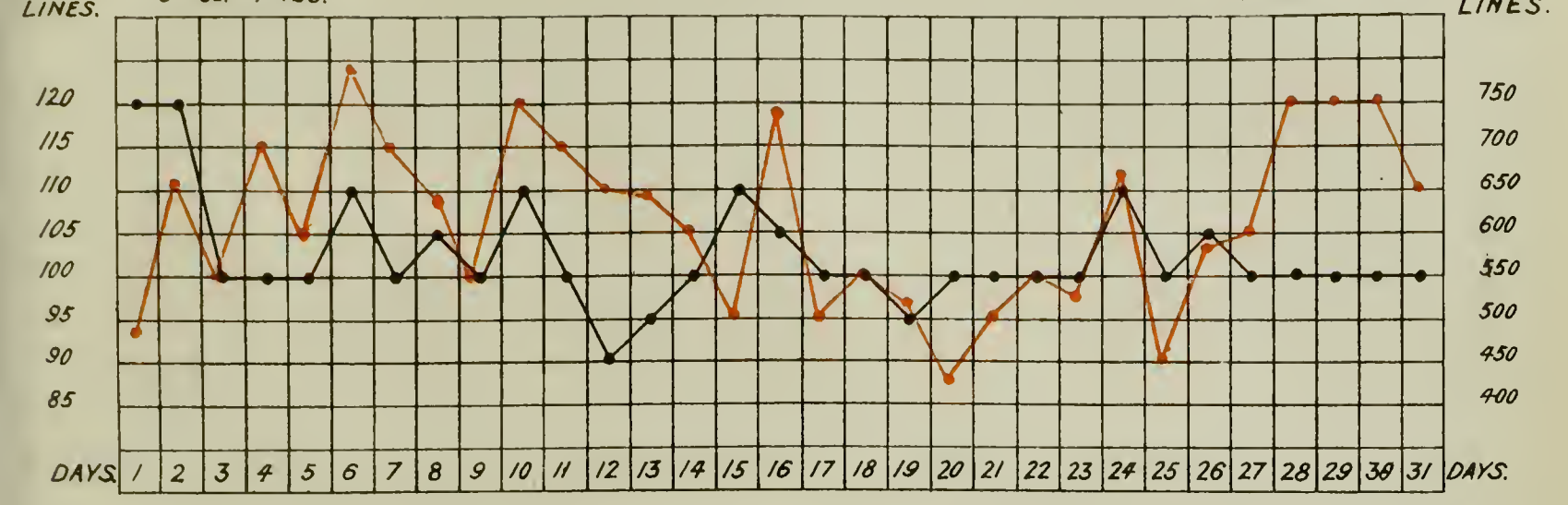
A. B. (MALE) ON DIET No1.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 1 lbs.

WEIGHT (AT END OF MONTH) 8 st. 11 lbs.

GRAINS UREA — RED LINES.



CASE No2

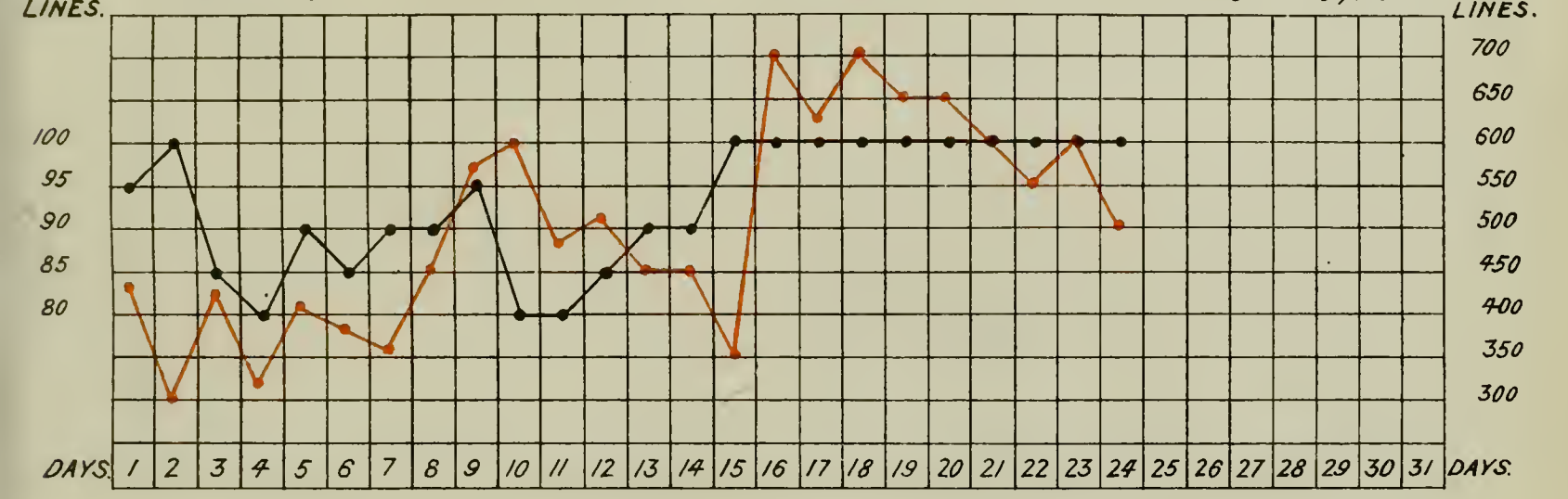
T. K. (MALE) ON DIET No1.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 0 lbs.

WEIGHT (AT END OF MONTH) 8 st. 13¾ lbs.

GRAINS UREA — RED LINES.



CASE No3

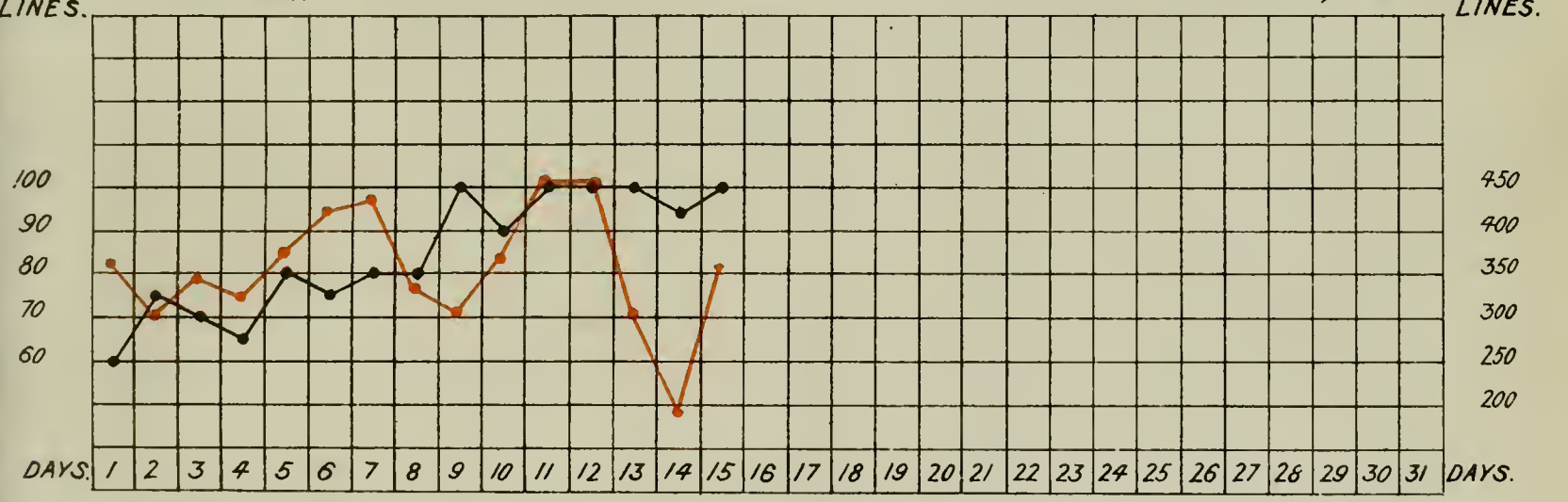
J. S. (MALE) ON DIET No1

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 8 lbs.

WEIGHT (AT END OF MONTH) 9 st. 6½ lbs.

GRAINS UREA — RED LINES.



CASE No4

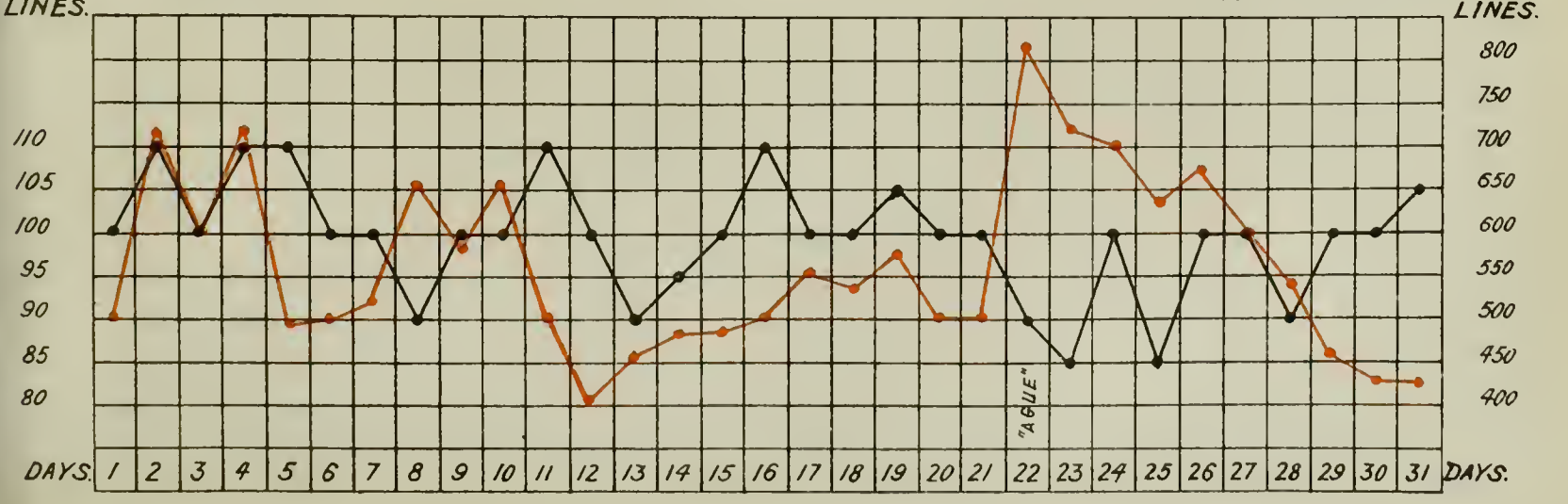
W. W. (MALE) ON DIET No1.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 7 lbs.

WEIGHT (AT END OF MONTH) 10 st. 2 lbs.

GRAINS UREA — RED LINES.



CASE No5

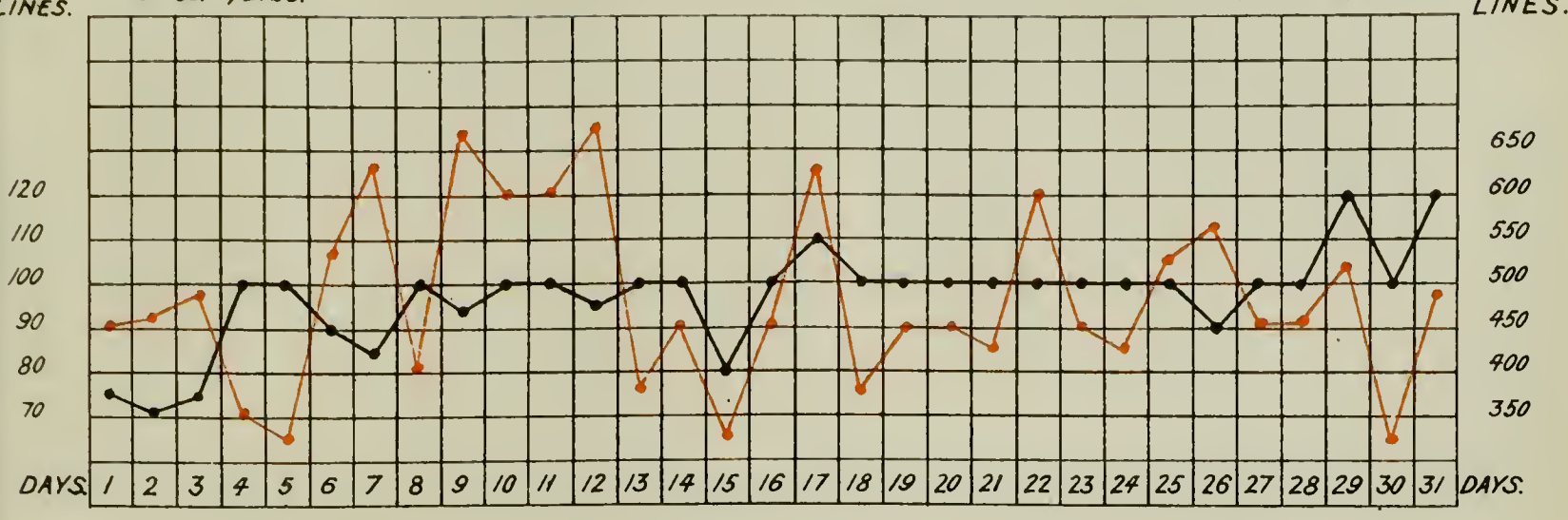
P. C. (MALE) ON DIET No 1

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 7½ lbs.

WEIGHT (AT END OF MONTH) 10 st. 6¼ lbs.

GRAINS UREA — RED LINES.



CASE No6

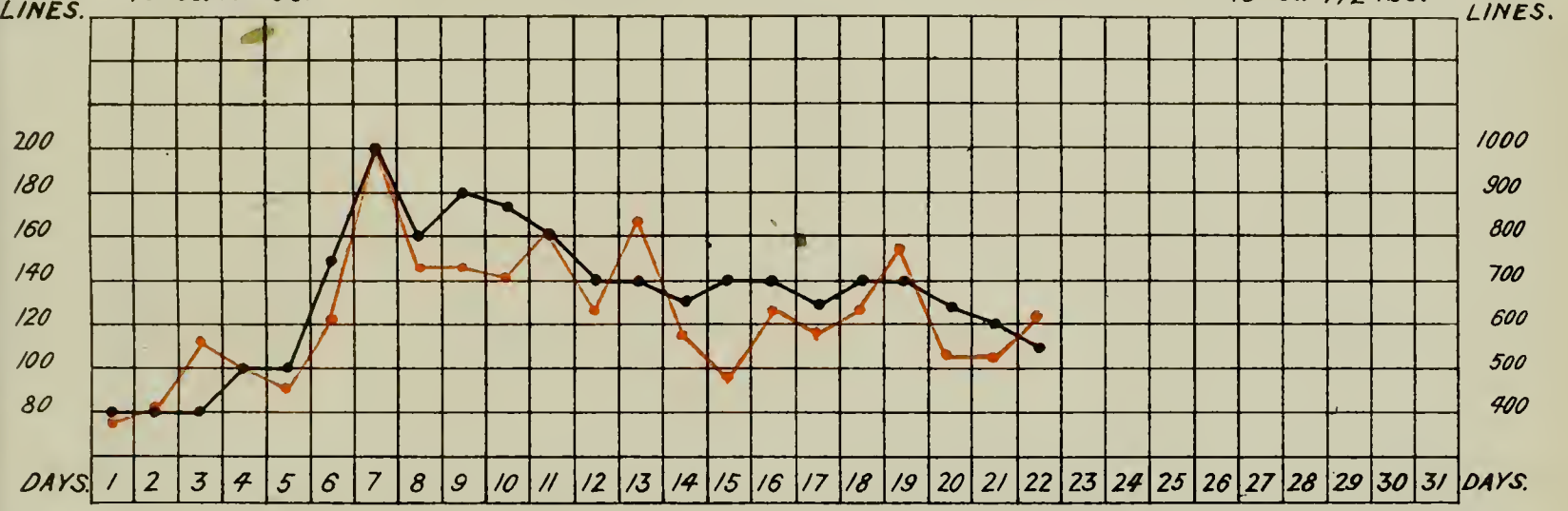
J. M. (MALE) ON DIET No 1.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 10 lbs.

WEIGHT (AT END OF MONTH) 10 st. 7½ lbs.

GRAINS UREA — RED LINES.



CASE No7

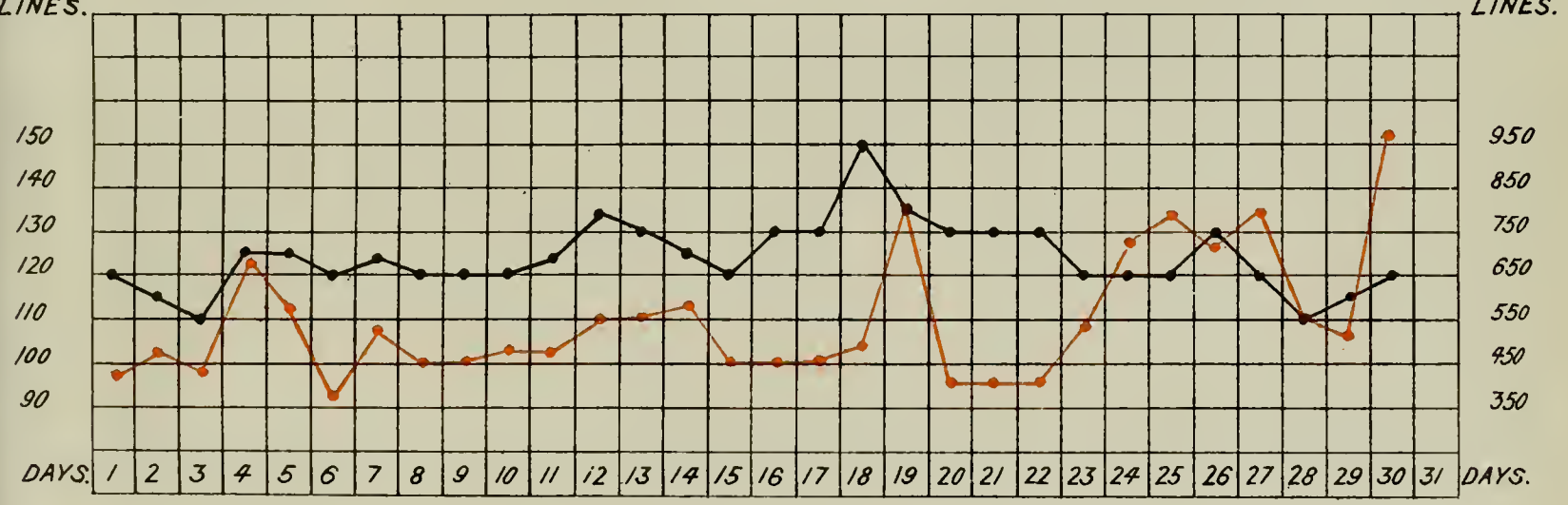
A. W. (MALE) ON DIET No 1.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 11 lbs.

WEIGHT (AT END OF MONTH) 10 st. 9 lbs.

GRAINS UREA — RED LINES.



CASE No8

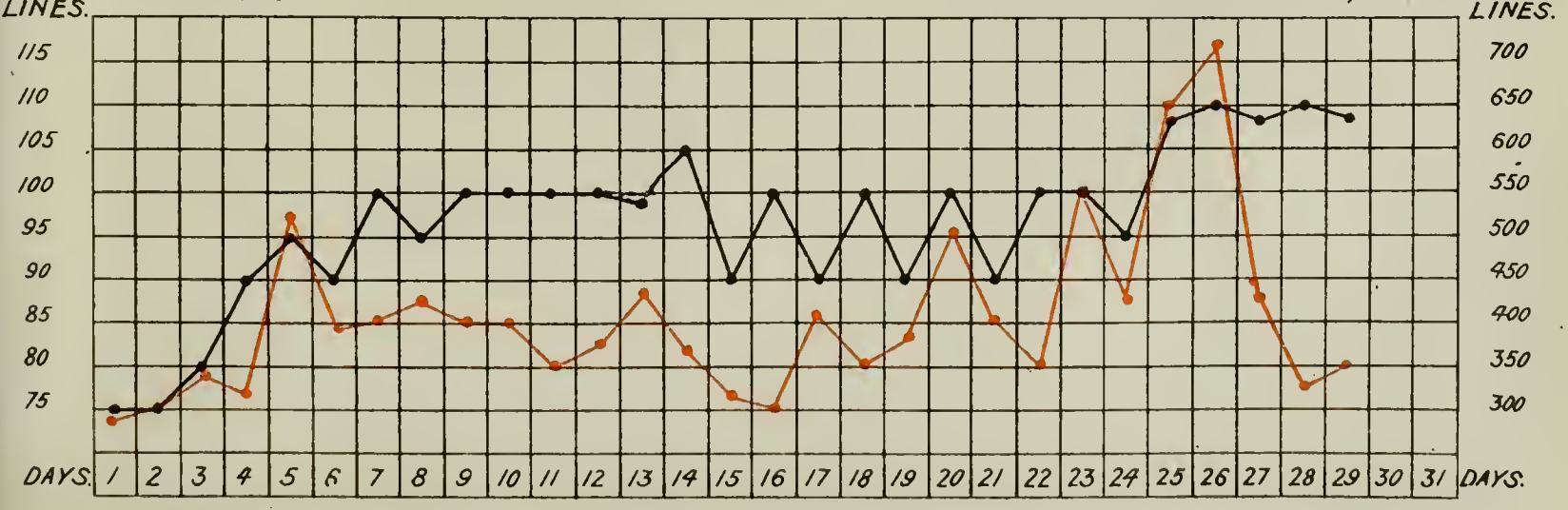
D. L. (MALE) ON DIET No 1

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 11 st. 5¾ lbs.

WEIGHT (AT END OF MONTH) 11 st. 8¾ lbs.

GRAINS UREA — RED LINES.



CASE Nº9

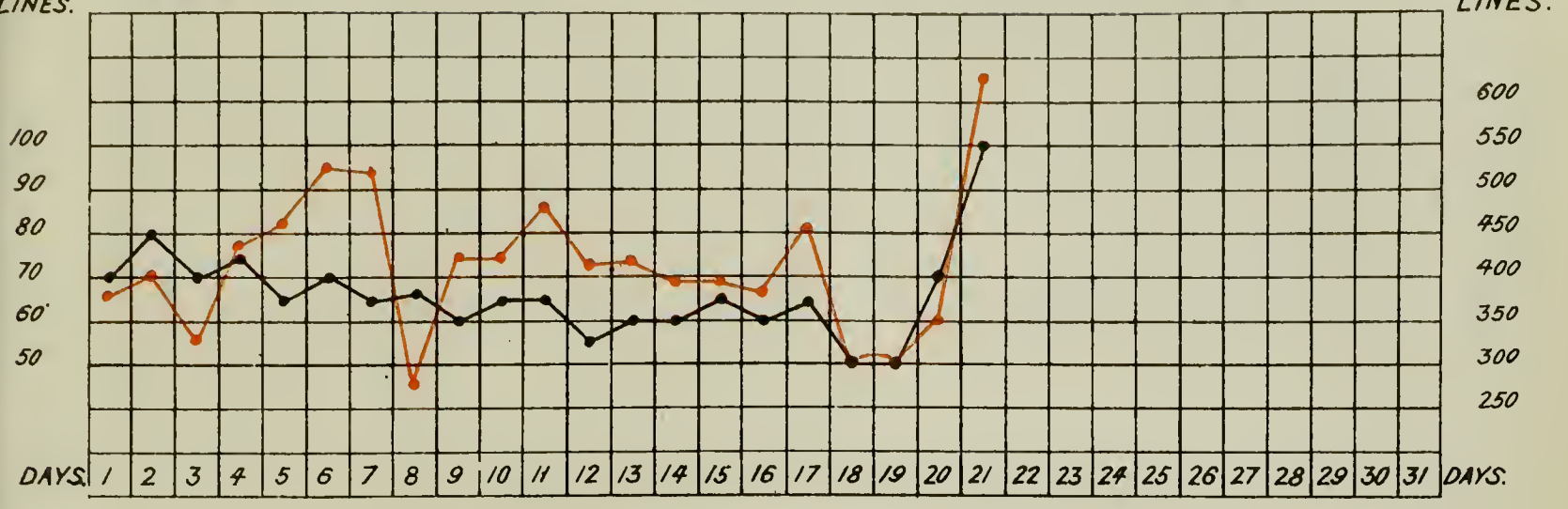
J. M. (MALE) ON DIET Nº1 + BEEF

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 5 lbs.

WEIGHT (AT END OF MONTH) 9 st. 6 lbs.

GRAINS UREA — RED LINES.



CASE Nº10

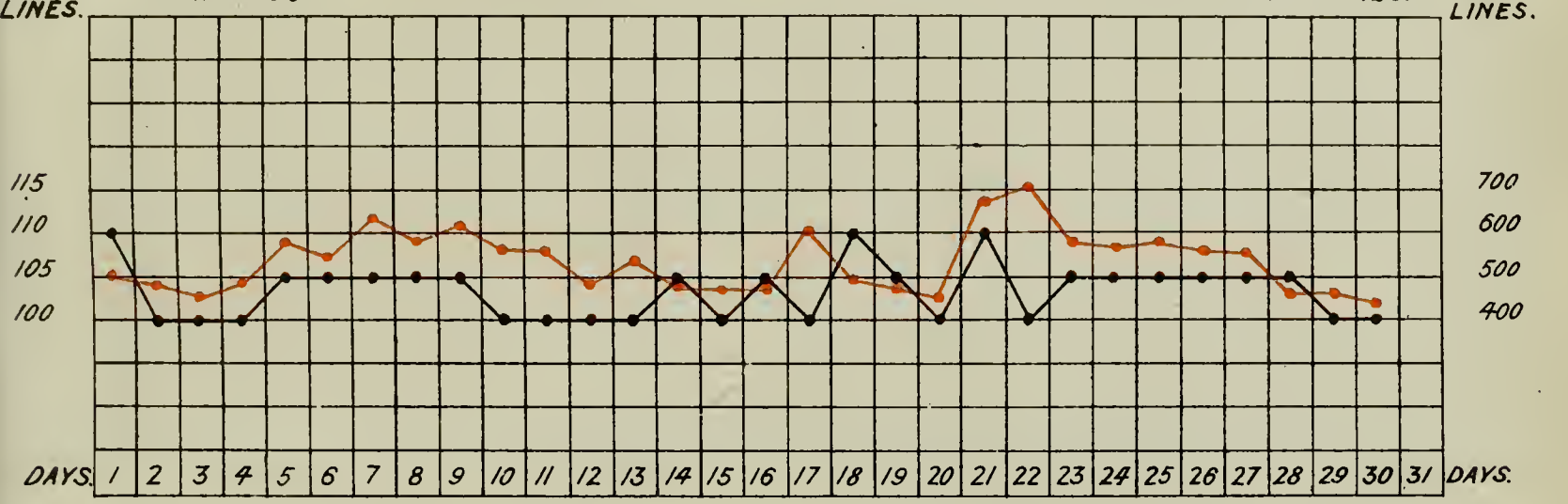
J. B. (MALE) ON DIET Nº1 + BEEF.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 13 lbs.

WEIGHT (AT END OF MONTH) 9 st. 10 lbs.

GRAINS UREA — RED LINES.



CASE Nº11

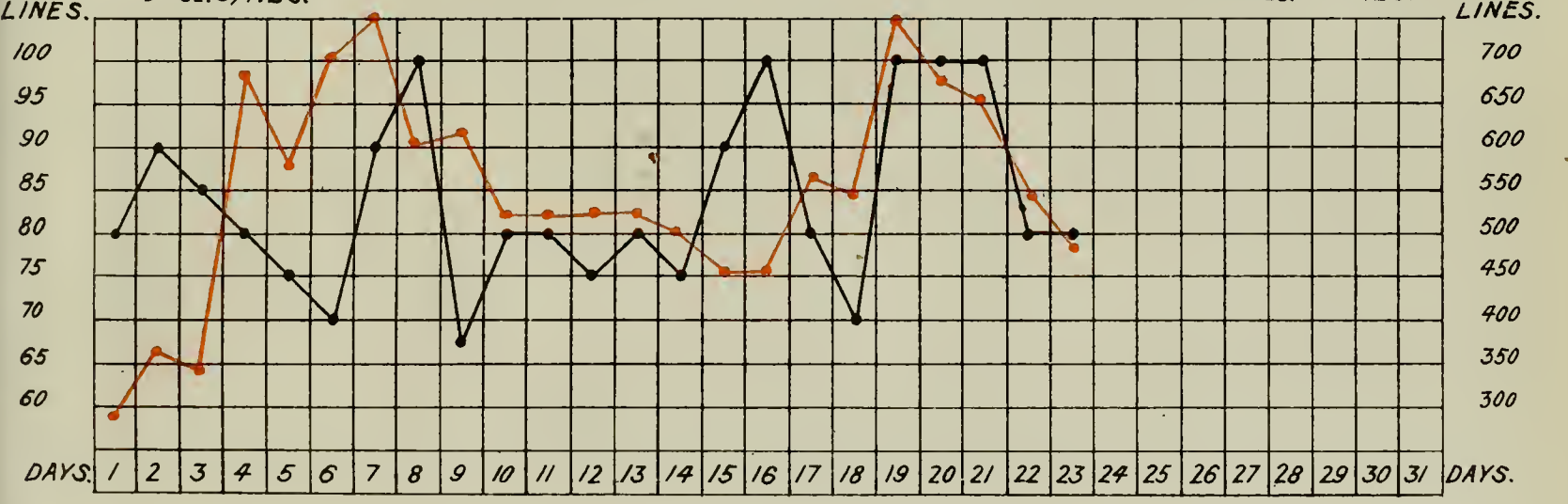
W. M. (MALE) ON DIET Nº2 + BEEF.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 8 st. 5¼ lbs.

WEIGHT (AT END OF MONTH) st. lbs.

GRAINS UREA — RED LINES.



CASE Nº12

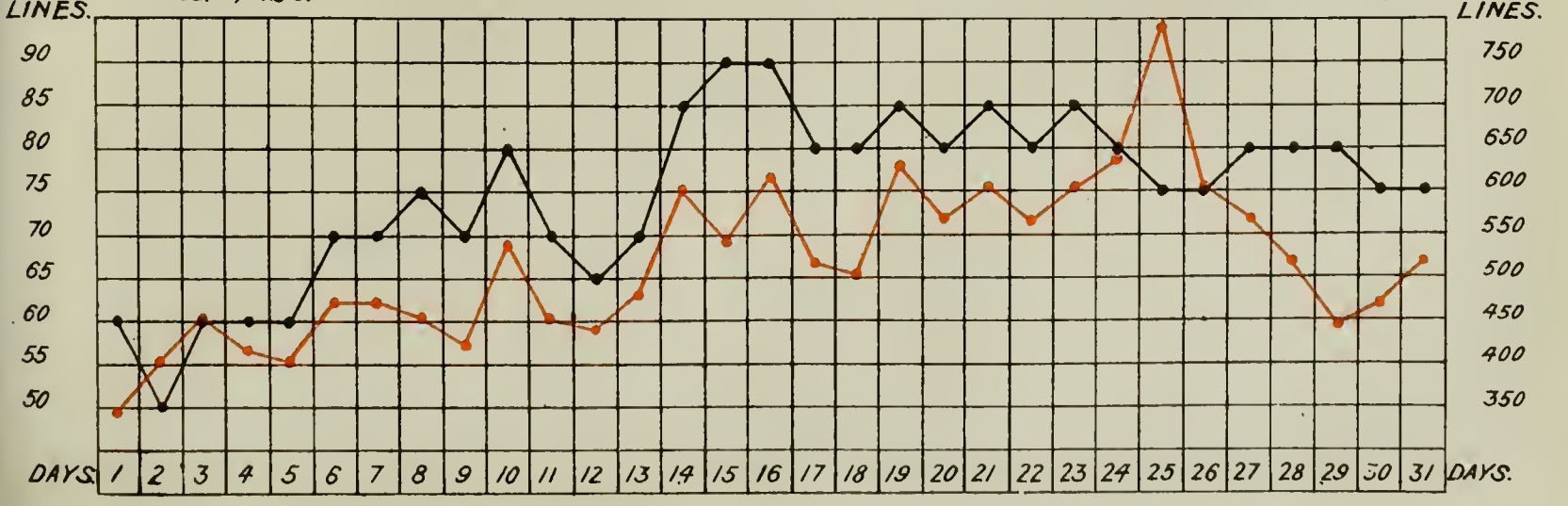
A. H. (MALE) ON DIET Nº2 + BEEF.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 8 st. 10¼ lbs.

WEIGHT (AT END OF MONTH) 8 st. 10 lbs.

GRAINS UREA — RED LINES.



CASE No13

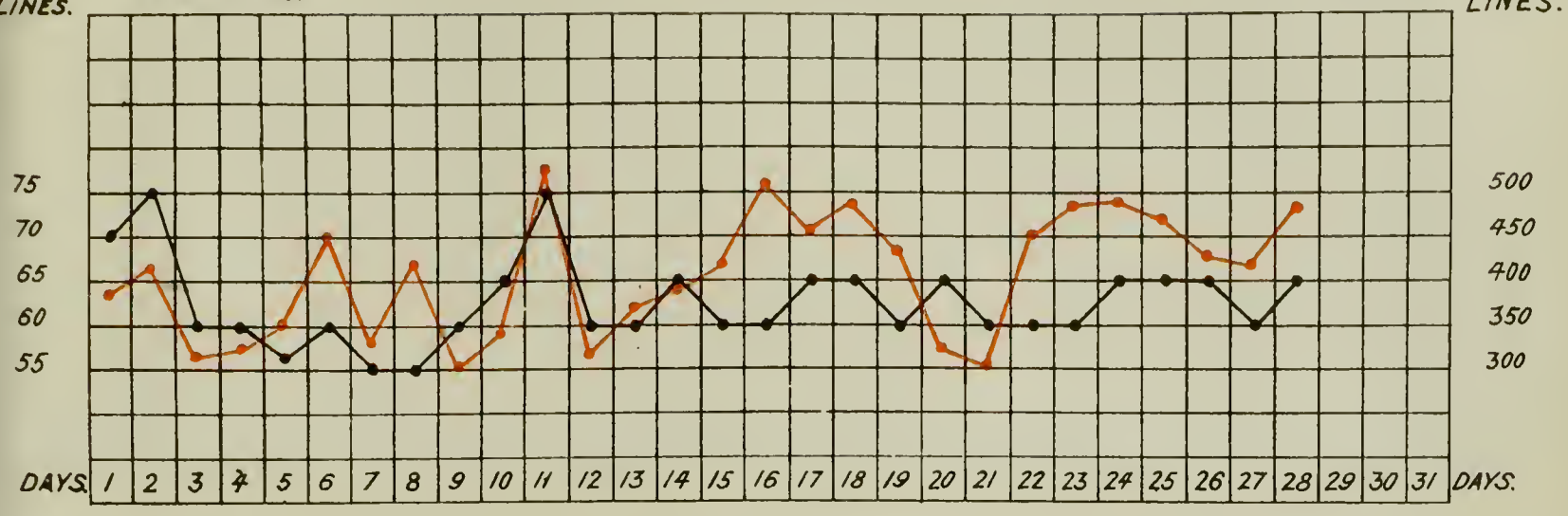
E. G. (MALE) ON DIET No2 + BEEF.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 8 st. 11 lbs.

WEIGHT (AT END OF MONTH) 8 st. 10 lbs.

GRAINS UREA — RED LINES.



CASE No14

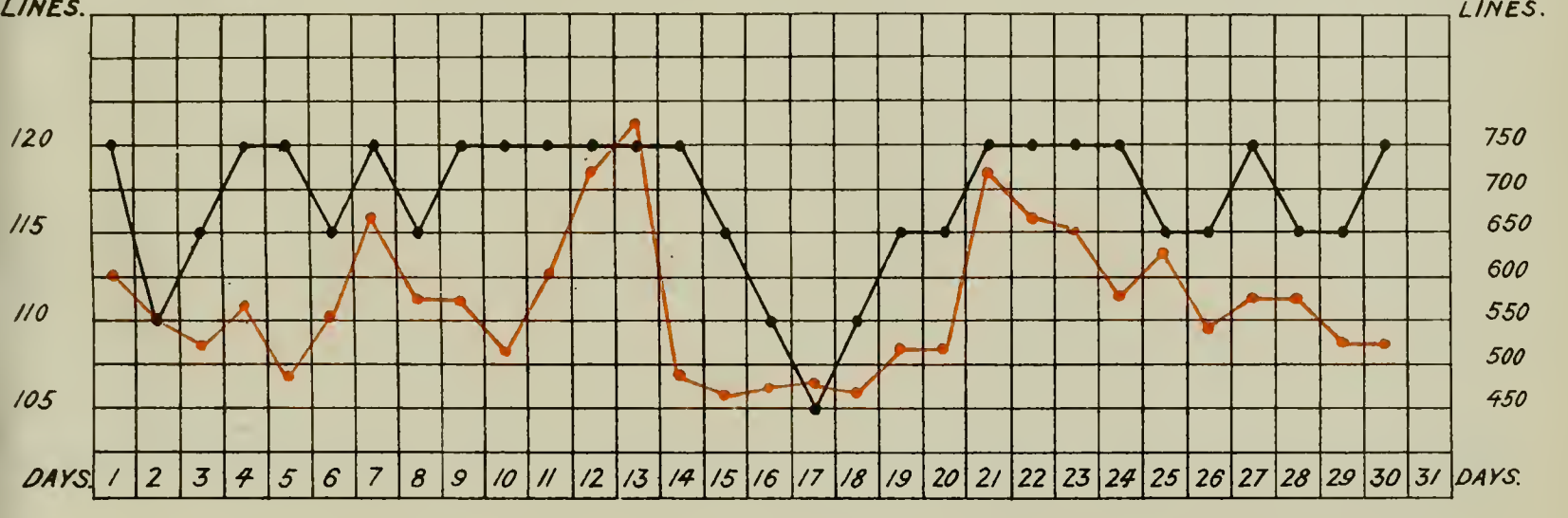
P. G. (MALE) ON DIET No2 + BEEF.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 11¼ lbs.

WEIGHT (AT END OF MONTH) 8 st. 13½ lbs.

GRAINS UREA — RED LINES.



CASE No15

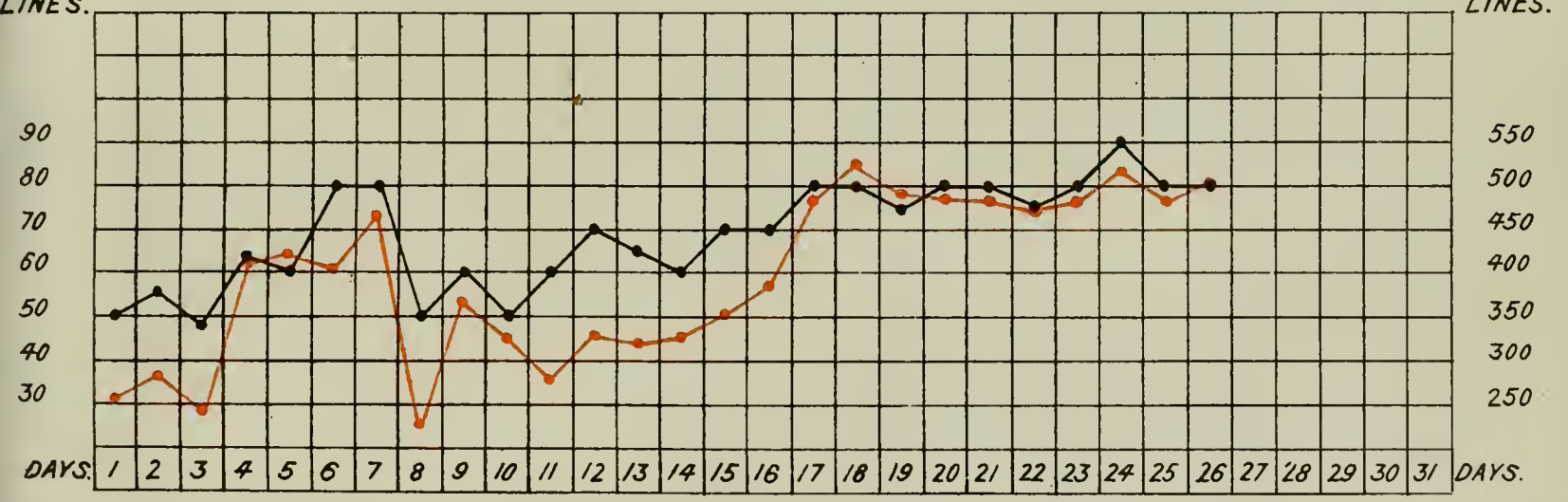
J. W. (MALE) ON DIET No2 + BEEF.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 2 lbs.

WEIGHT (AT END OF MONTH) 9 st. 10¼ lbs.

GRAINS UREA — RED LINES.



CASE No16

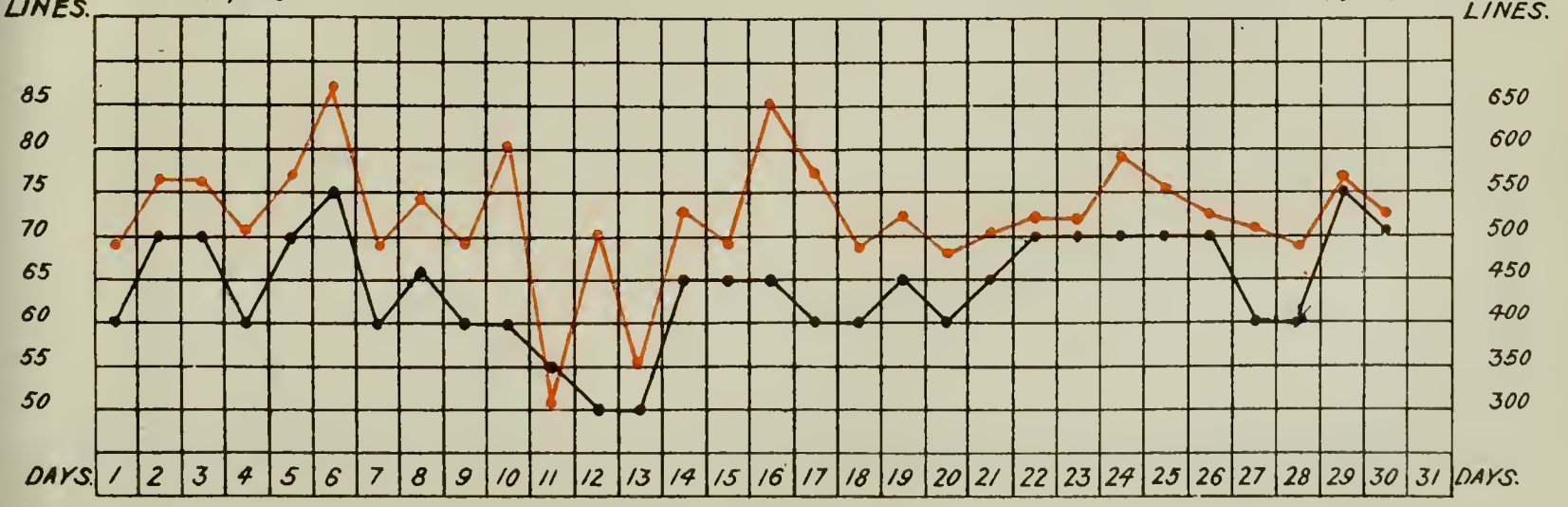
R. M. (MALE) ON DIET No2 + BEEF.

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 11½ lbs.

WEIGHT (AT END OF MONTH) 9 st. 10 lbs.

GRAINS UREA — RED LINES.



CASE No17

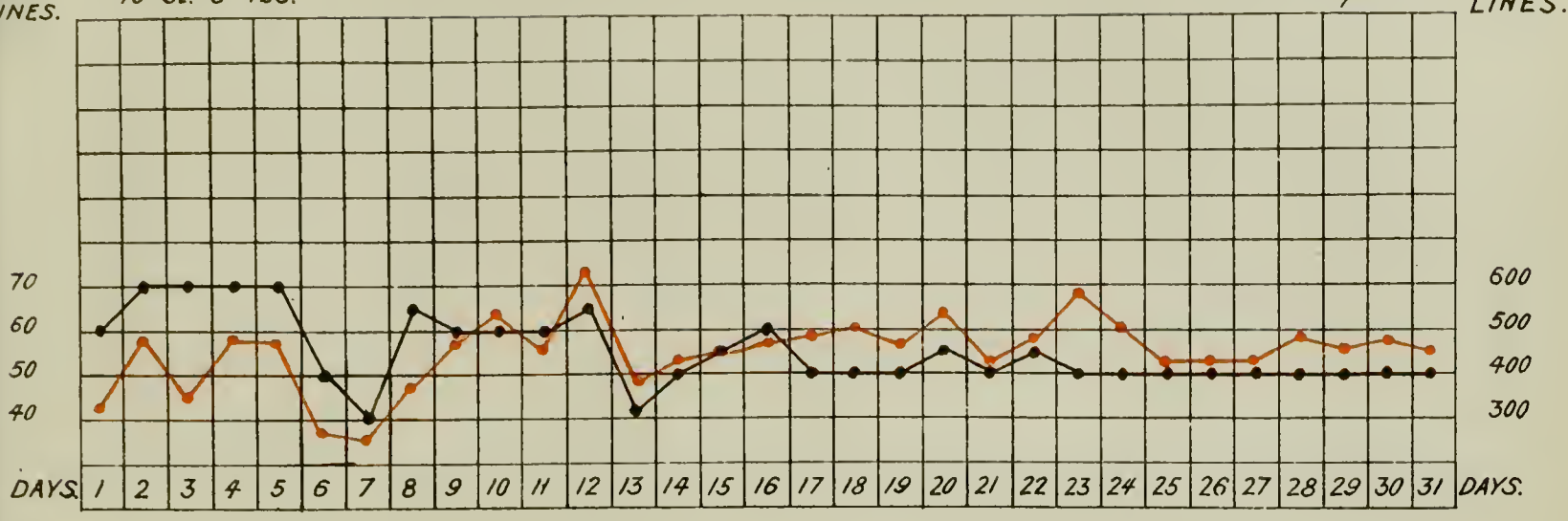
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 6 lbs.

J. M. (MALE) ON DIET No2 + BEEF.

WEIGHT (AT END OF MONTH) 10 st. 3¾ lbs.

GRAINS UREA — RED LINES.



CASE No18

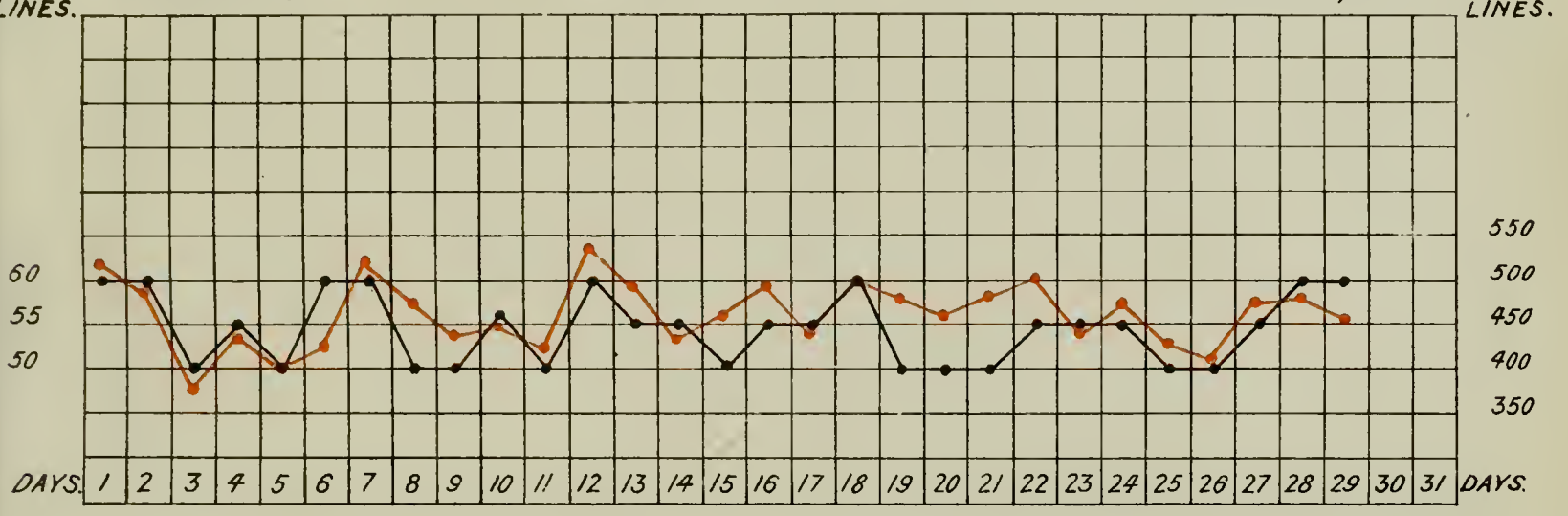
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 11 lbs.

A. D. (MALE) ON DIET No2 + BEEF.

WEIGHT (AT END OF MONTH) 10 st. 12½ lbs.

GRAINS UREA — RED LINES.



CASE No19

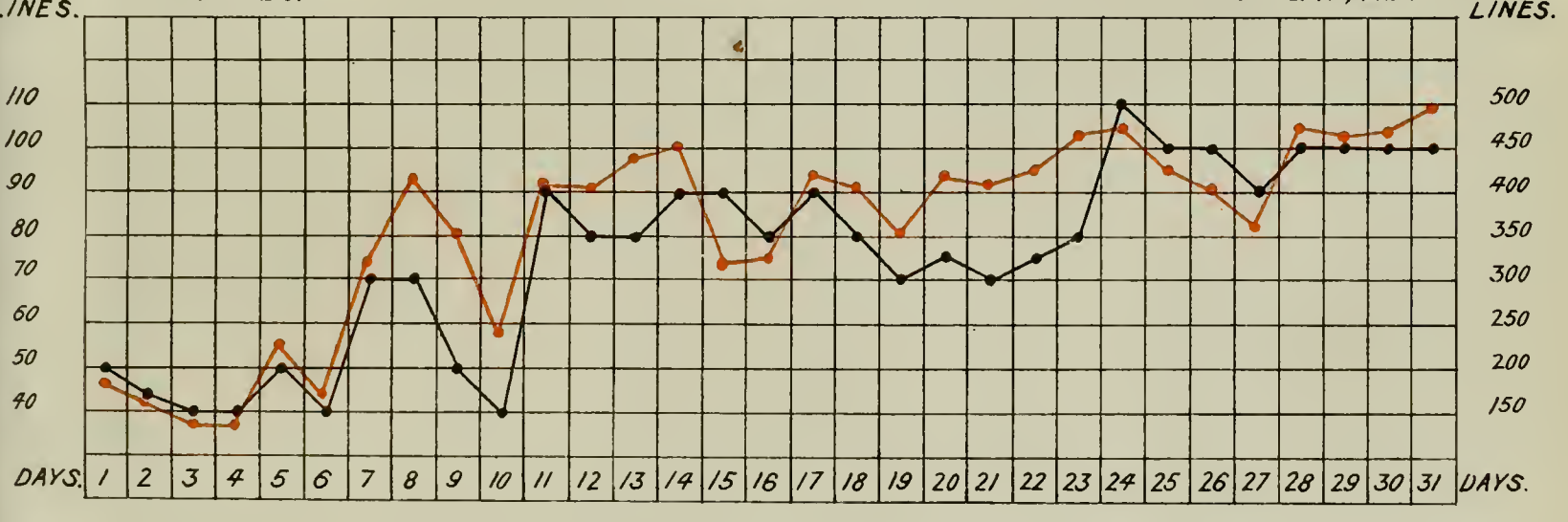
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 11 st. 2 lbs.

A. A. (MALE) ON DIET No2 + BEEF.

WEIGHT (AT END OF MONTH) 10 st. 11¾ lbs.

GRAINS UREA — RED LINES.



CASE No20

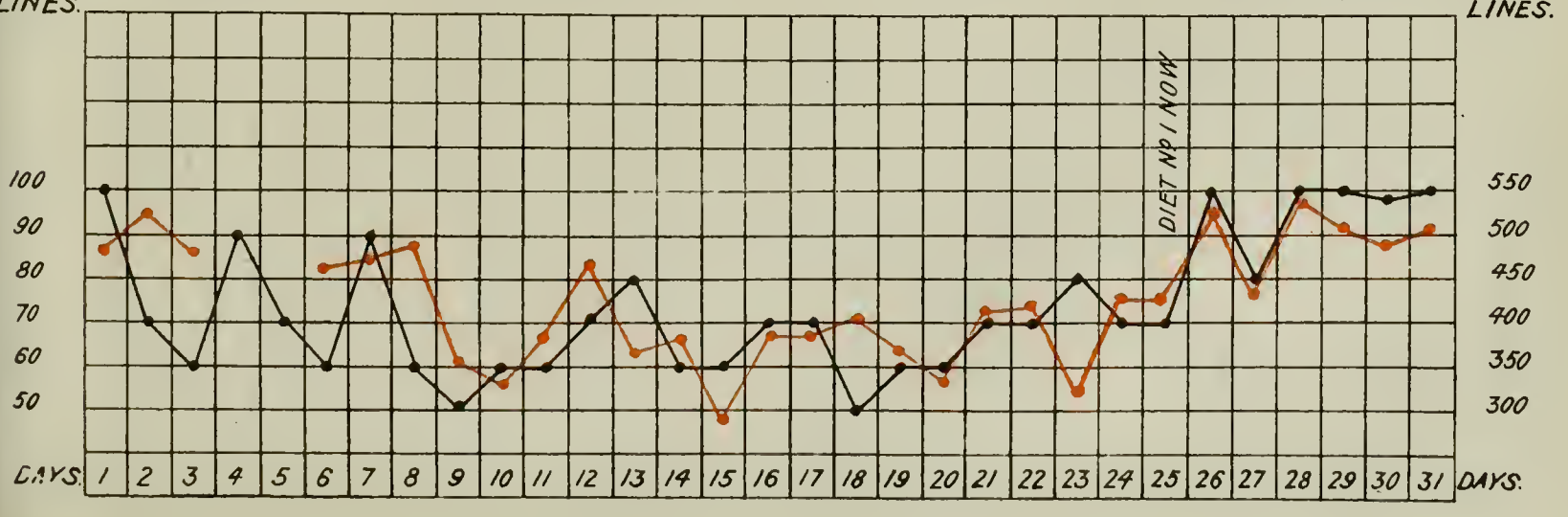
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 8 st. 11 lbs.

J. McA. (MALE) ON DIET No2 + BEEF, AND THEN ON DIET No1, WITHOUT BEEF.

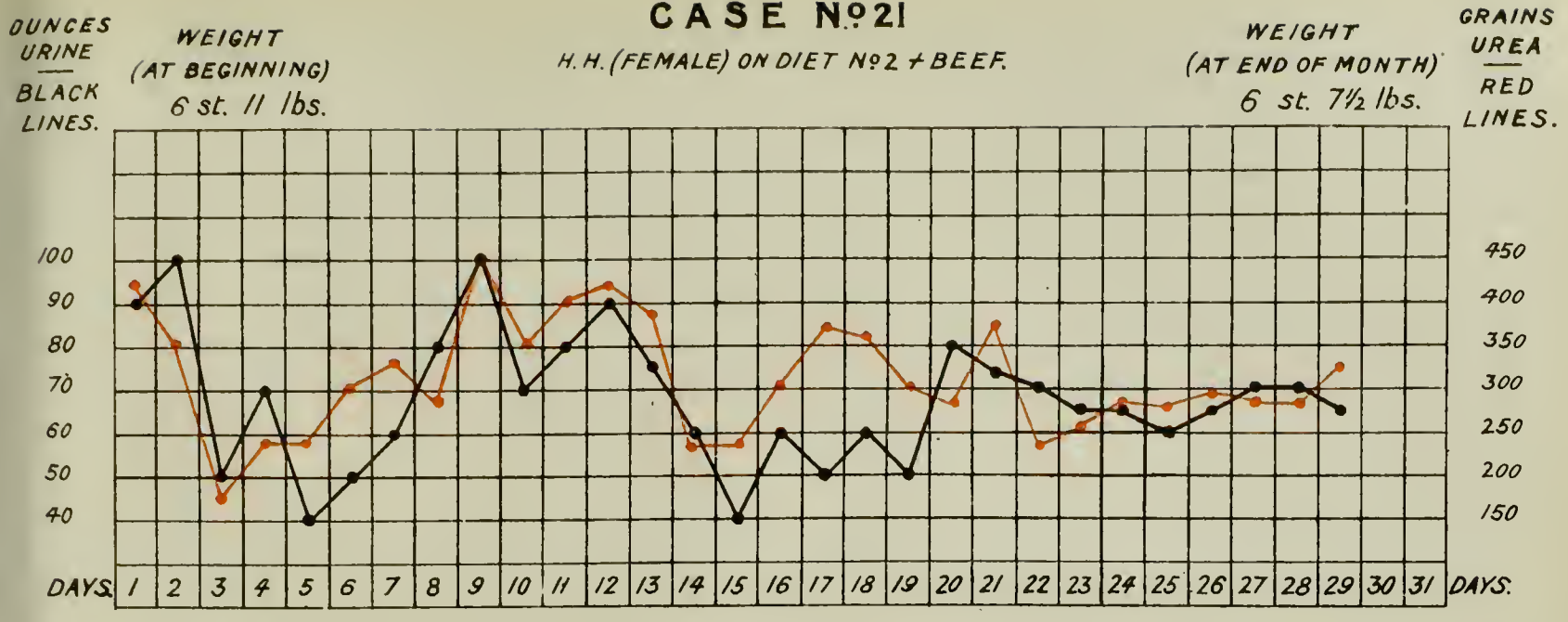
WEIGHT (AT END OF MONTH) 8 st. 12¼ lbs.

GRAINS UREA — RED LINES.



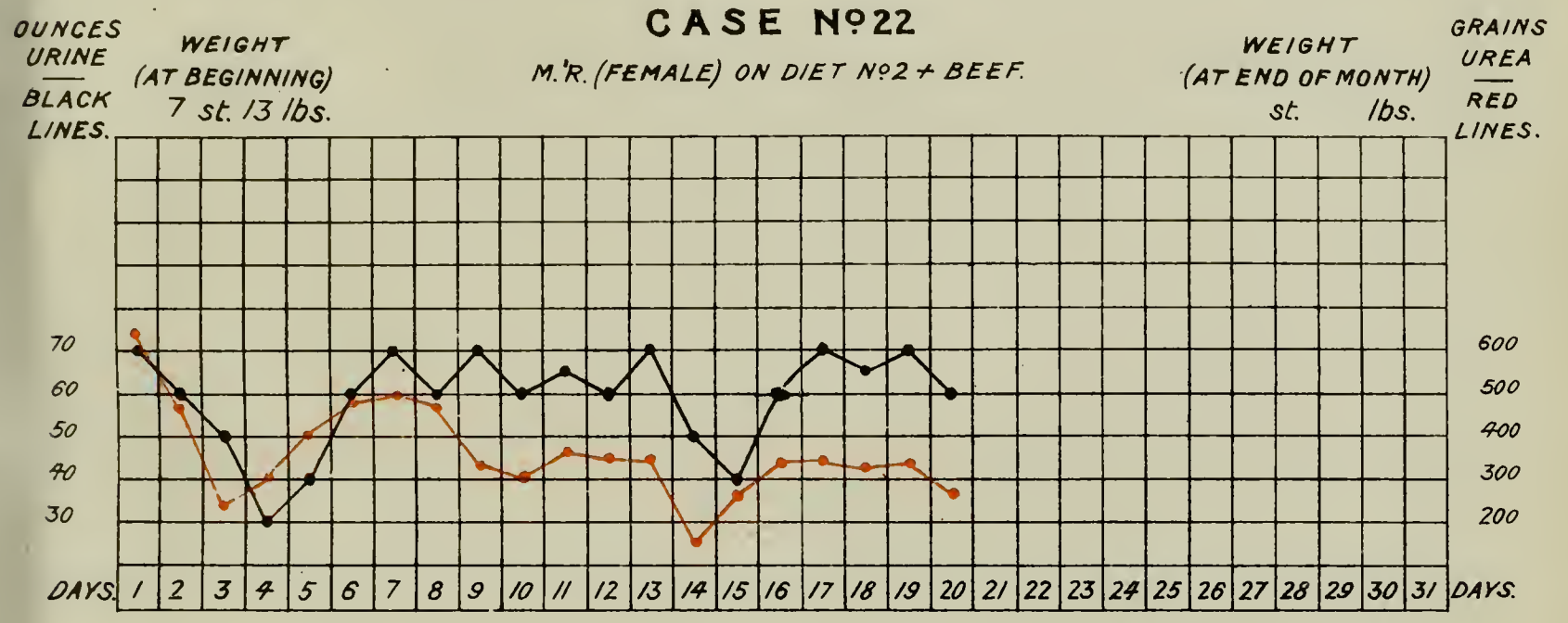
CASE No. 21

H. H. (FEMALE) ON DIET No. 2 + BEEF.



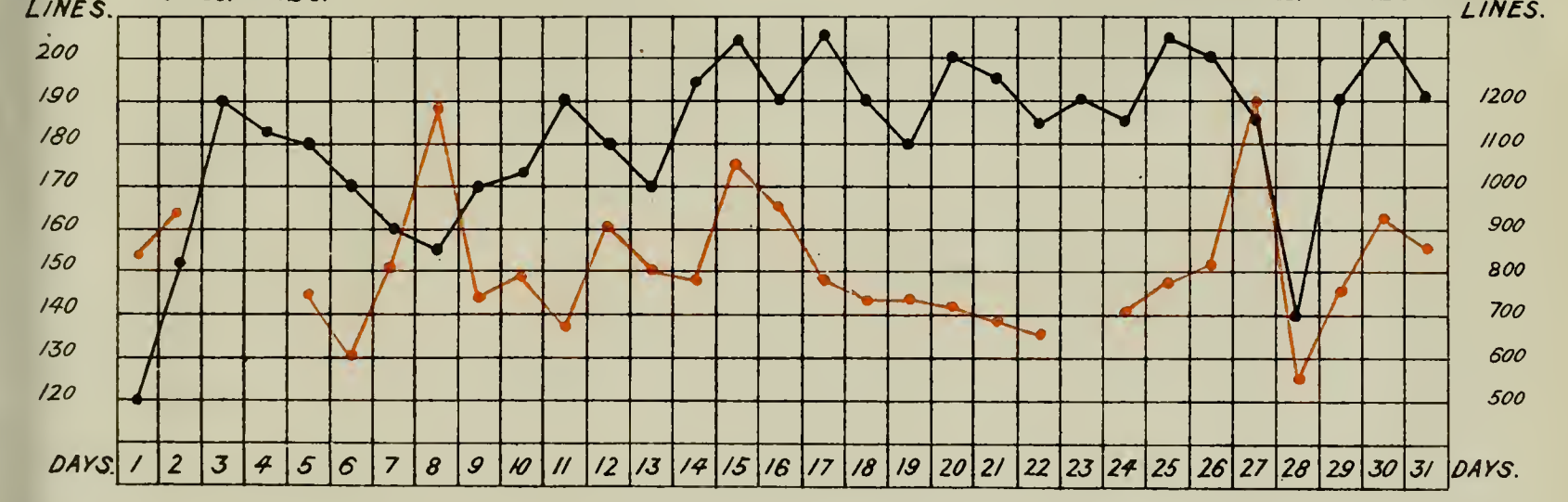
CASE No. 22

M. R. (FEMALE) ON DIET No. 2 + BEEF.



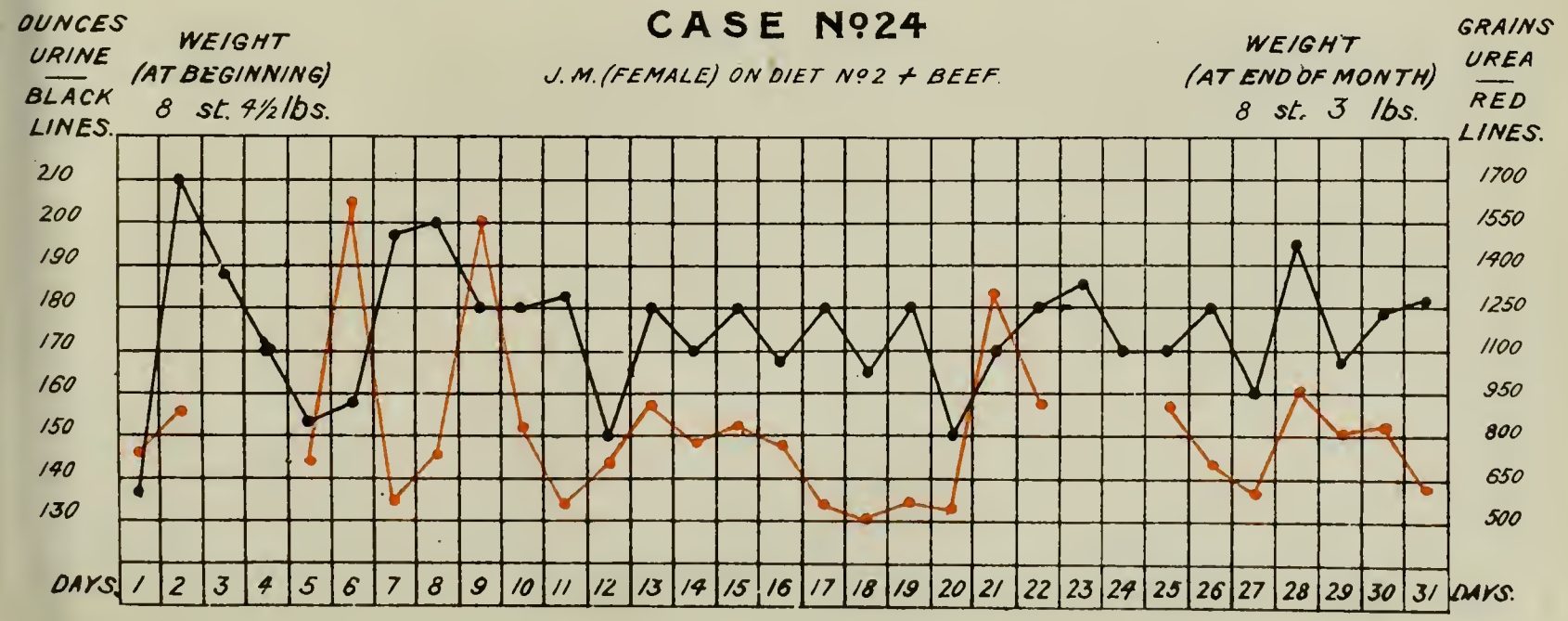
CASE No. 23

A. Q. (FEMALE) ON DIET No. 2 + BEEF.



CASE No. 24

J. M. (FEMALE) ON DIET No. 2 + BEEF.



CASE Nº25

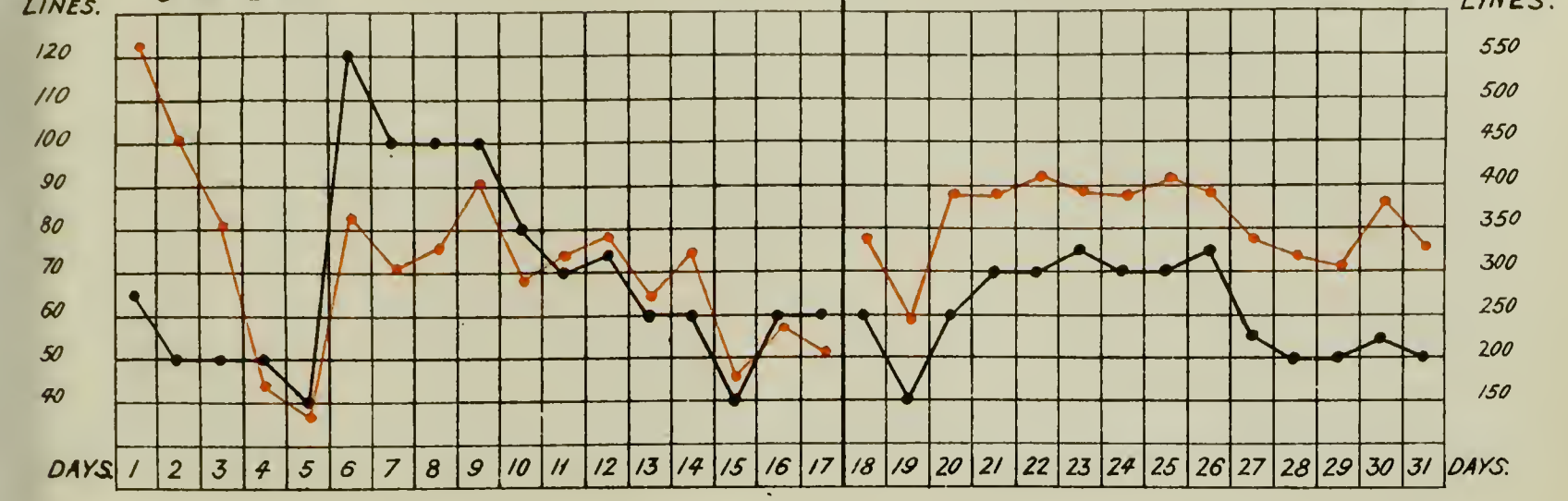
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 6 st. 12 lbs.

E.C. (FEMALE) 17 DAYS ON DIET Nº2 + BEEF. 14 DAYS ON Nº2 (NO BEEF)

WEIGHT (AT END OF MONTH) 6 st. 12 lbs.

GRAINS UREA — RED LINES.



CASE Nº26

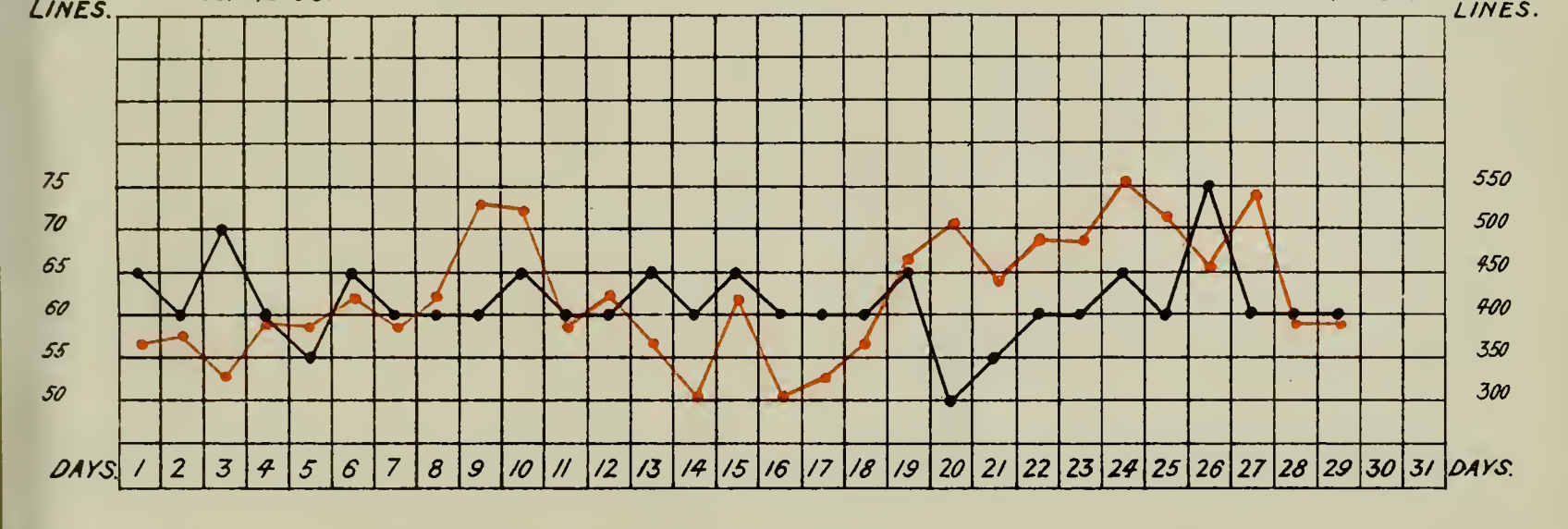
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 2½ lbs.

D. McG. (MALE) ON DIET Nº2.

WEIGHT (AT END OF MONTH) 8 st. 13½ lbs.

GRAINS UREA — RED LINES.



CASE Nº27

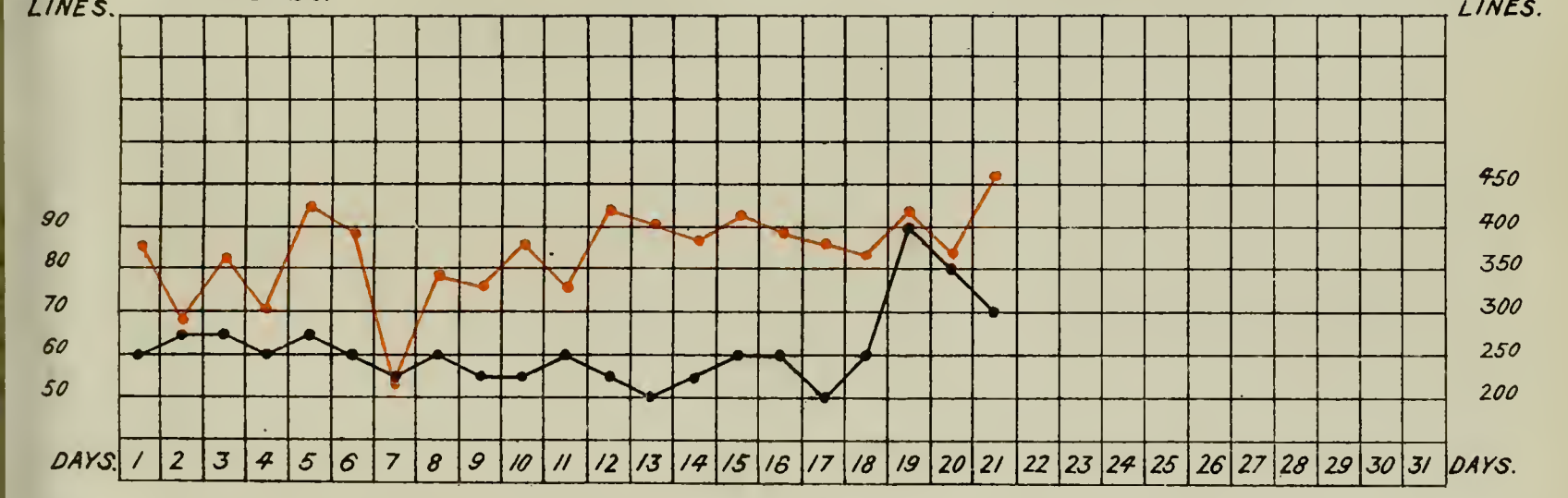
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 3 lbs.

P. McG. (MALE) ON DIET Nº2.

WEIGHT (AT END OF MONTH) 9 st. 5 lbs.

GRAINS UREA — RED LINES.



CASE Nº28

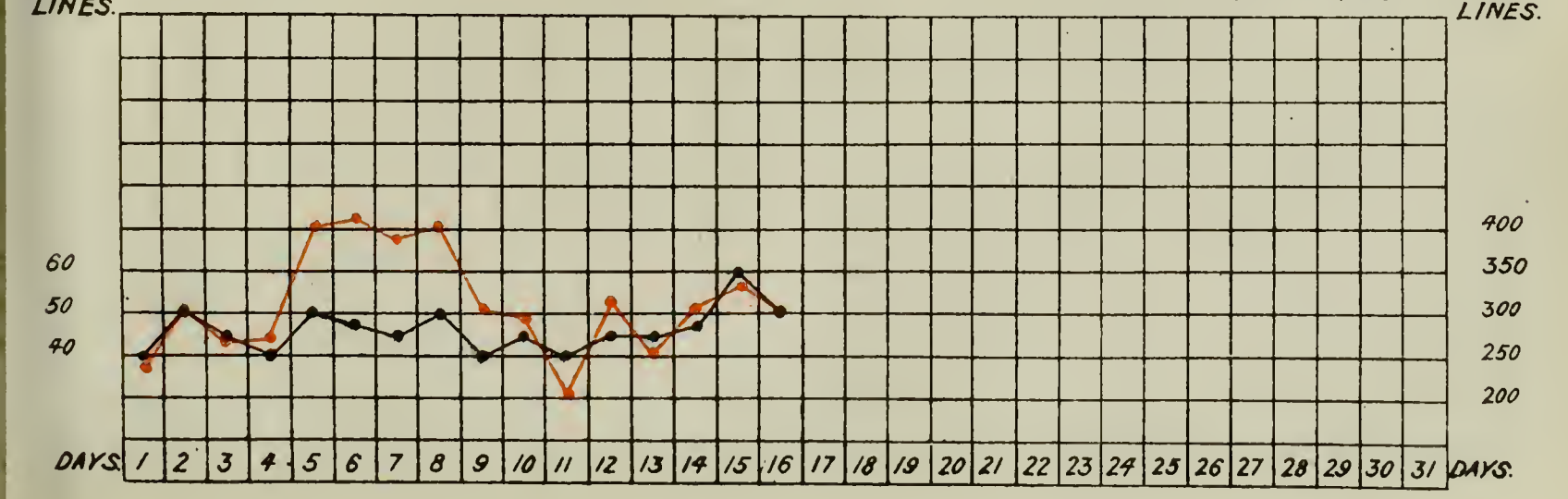
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 7 lbs.

J.C. (MALE) ON DIET Nº2.

WEIGHT (AT END OF MONTH) 10 st. 4½ lbs.

GRAINS UREA — RED LINES.



CASE Nº29

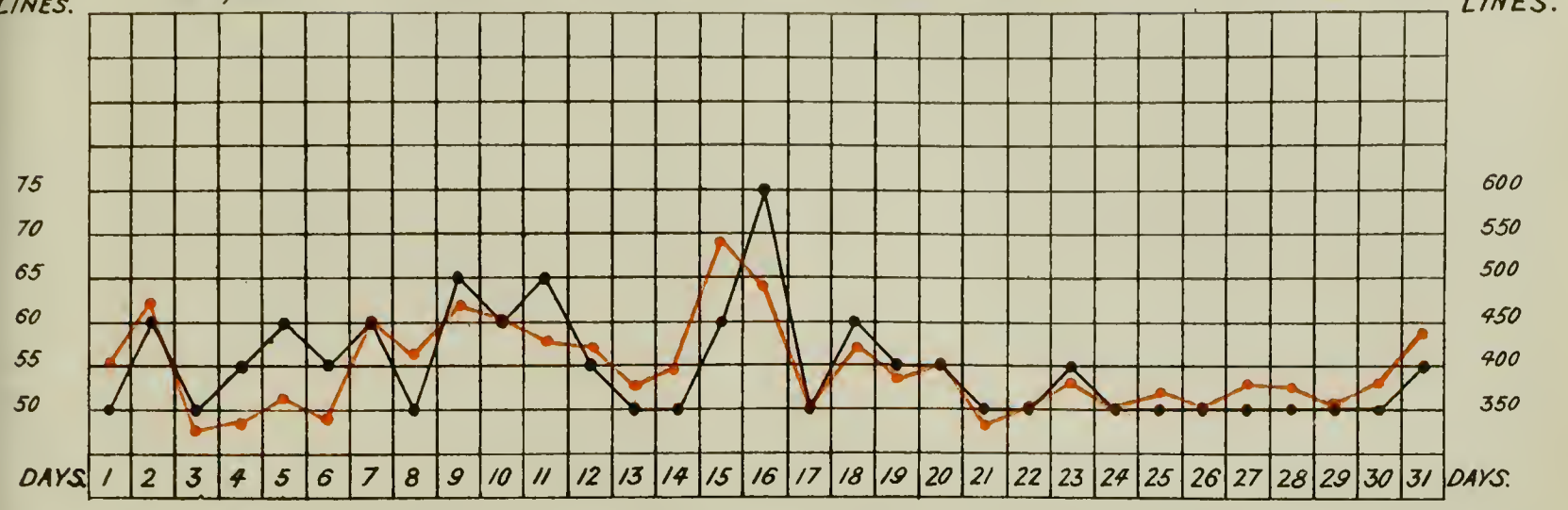
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 7 st. 1½ lbs.

J.S. (MALE) ON DIET Nº2 WITH ½ PINT OF SKIMMED MILK FOR ¾ PINT BUTTERMILK; + BEEF & RICE SOUP.

WEIGHT (AT END OF MONTH) 7 st. 2 lbs.

GRAINS UREA — RED LINES.



CASE Nº30

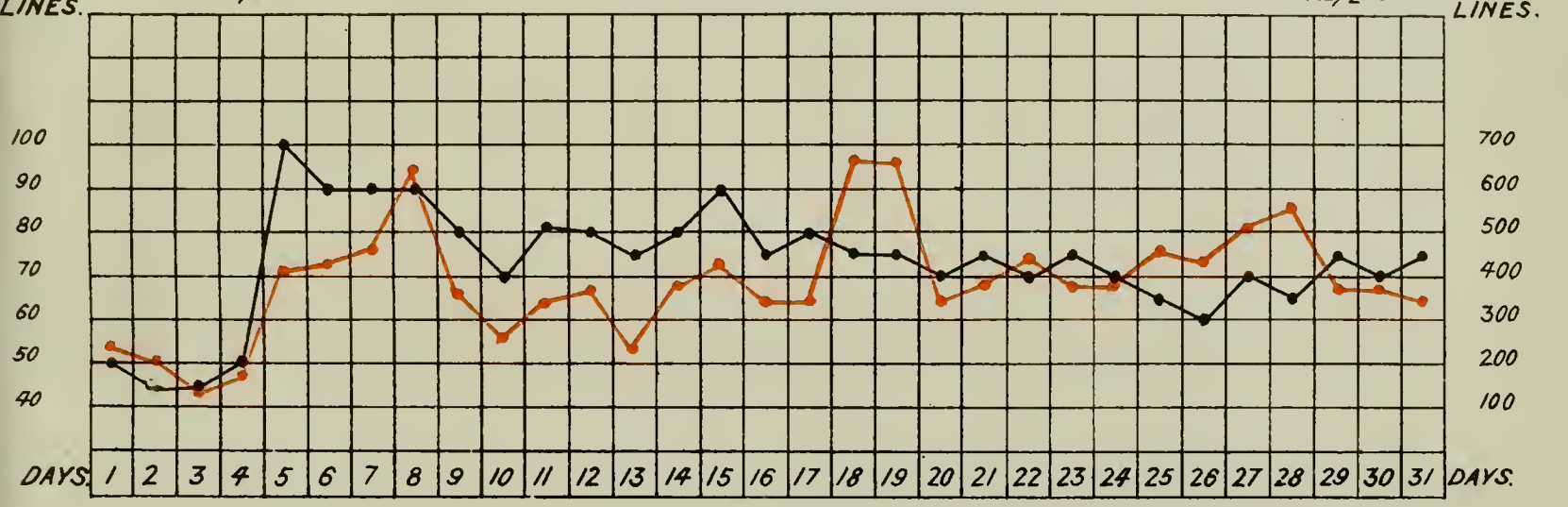
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 7 st. 12½ lbs.

J. McP. (MALE) ON DIET Nº2 WITH BEEF, TWICE, WEEKLY.

WEIGHT (AT END OF MONTH) 7 st. 12½ lbs.

GRAINS UREA — RED LINES.



CASE Nº31

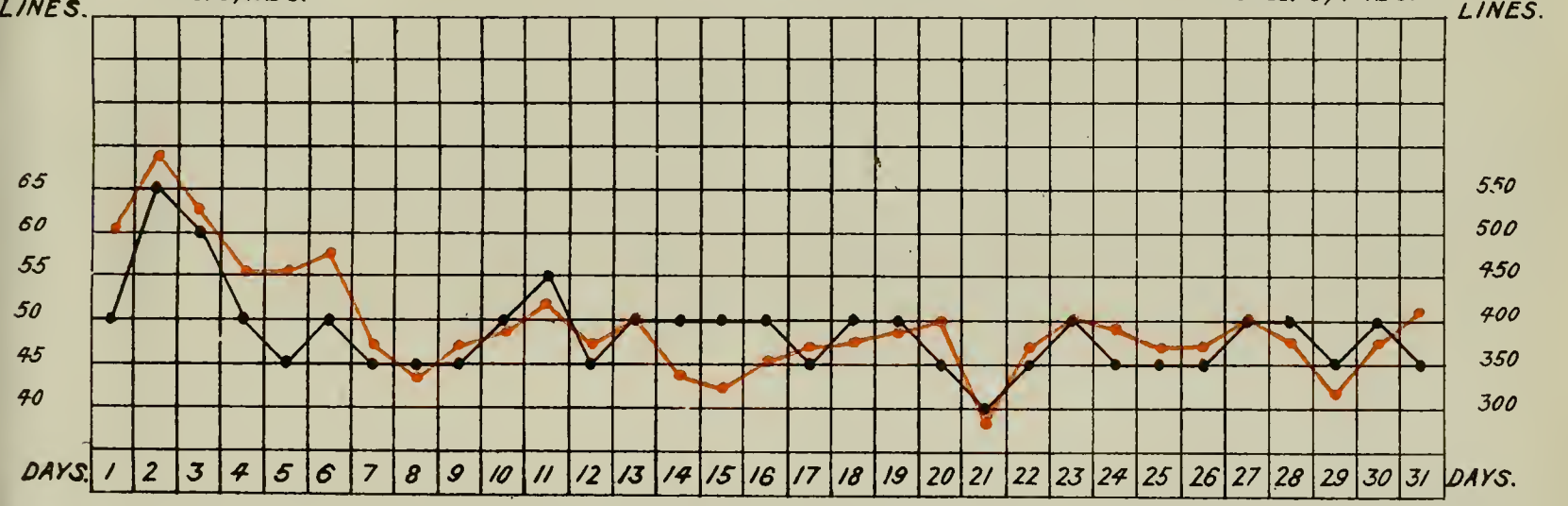
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 8 st. 8¾ lbs.

R.F. (MALE) ON DIET Nº2 WITH TEA, AGAIN, FOR PORRIDGE & BUTTERMILK.

WEIGHT (AT END OF MONTH) 8 st. 8¼ lbs.

GRAINS UREA — RED LINES.



CASE Nº32

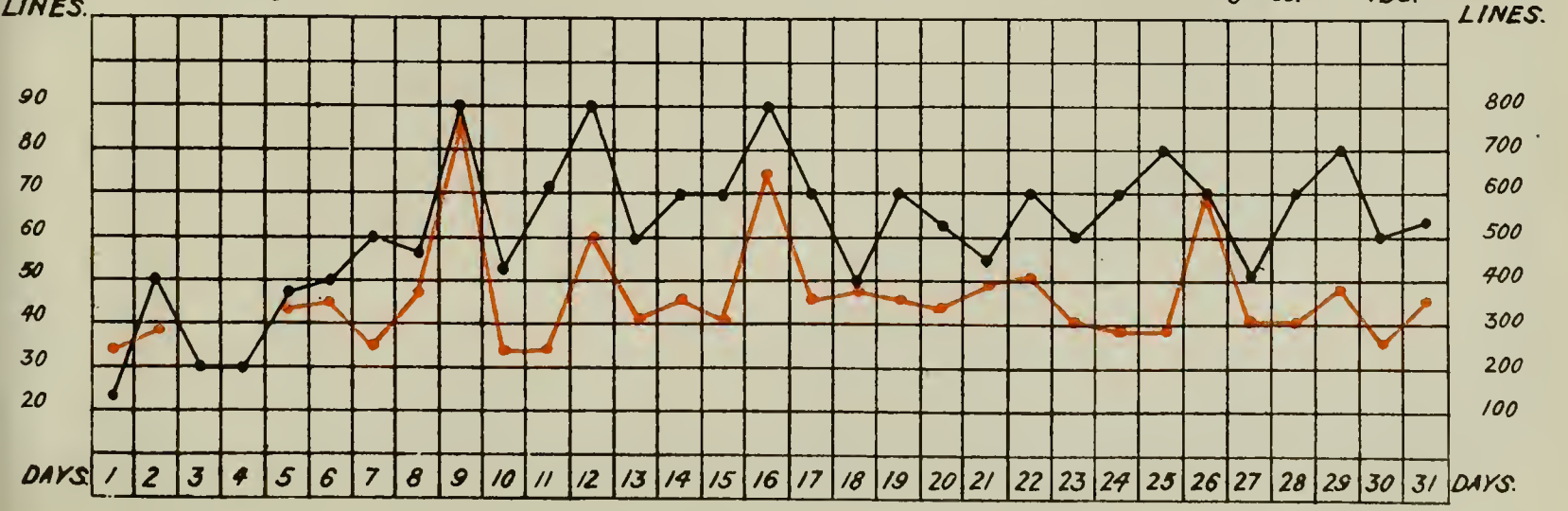
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 7 st. 7 lbs.

L.B. (FEMALE) ON DIET Nº2 + BEEFTEA & SWEET MILK.

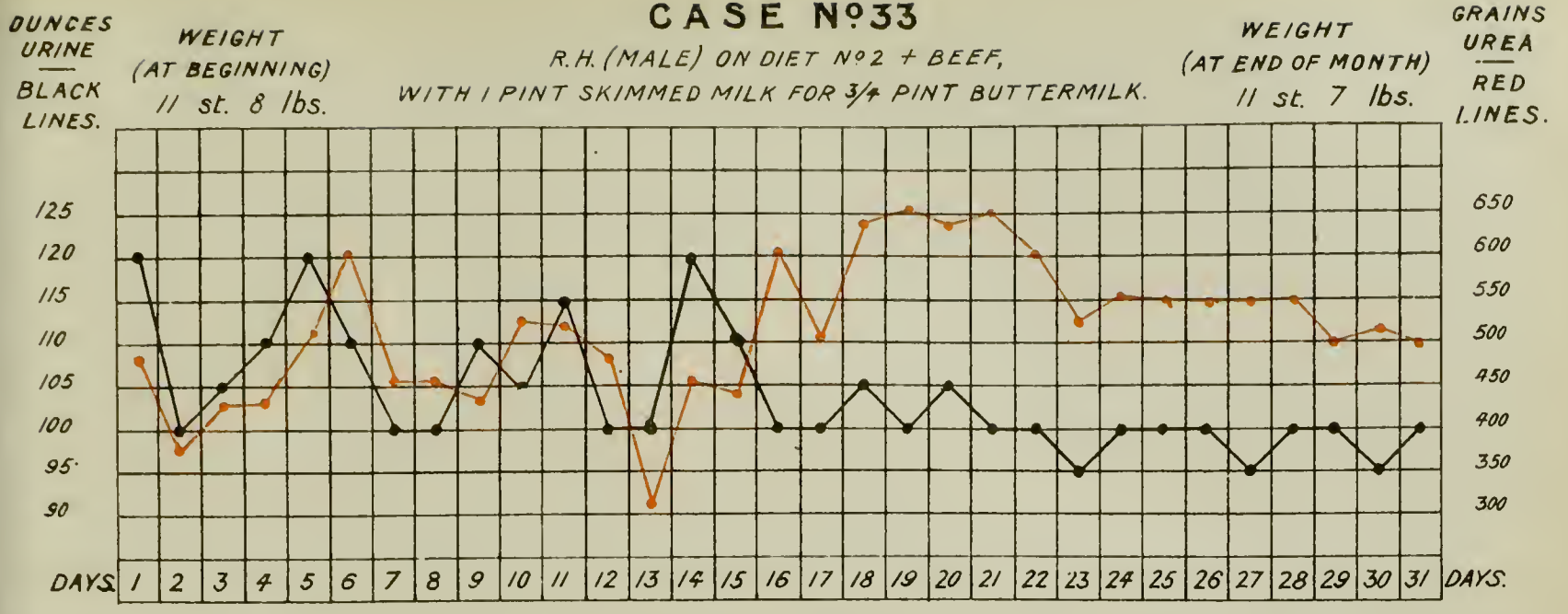
WEIGHT (AT END OF MONTH) 8 st. = lbs.

GRAINS UREA — RED LINES.



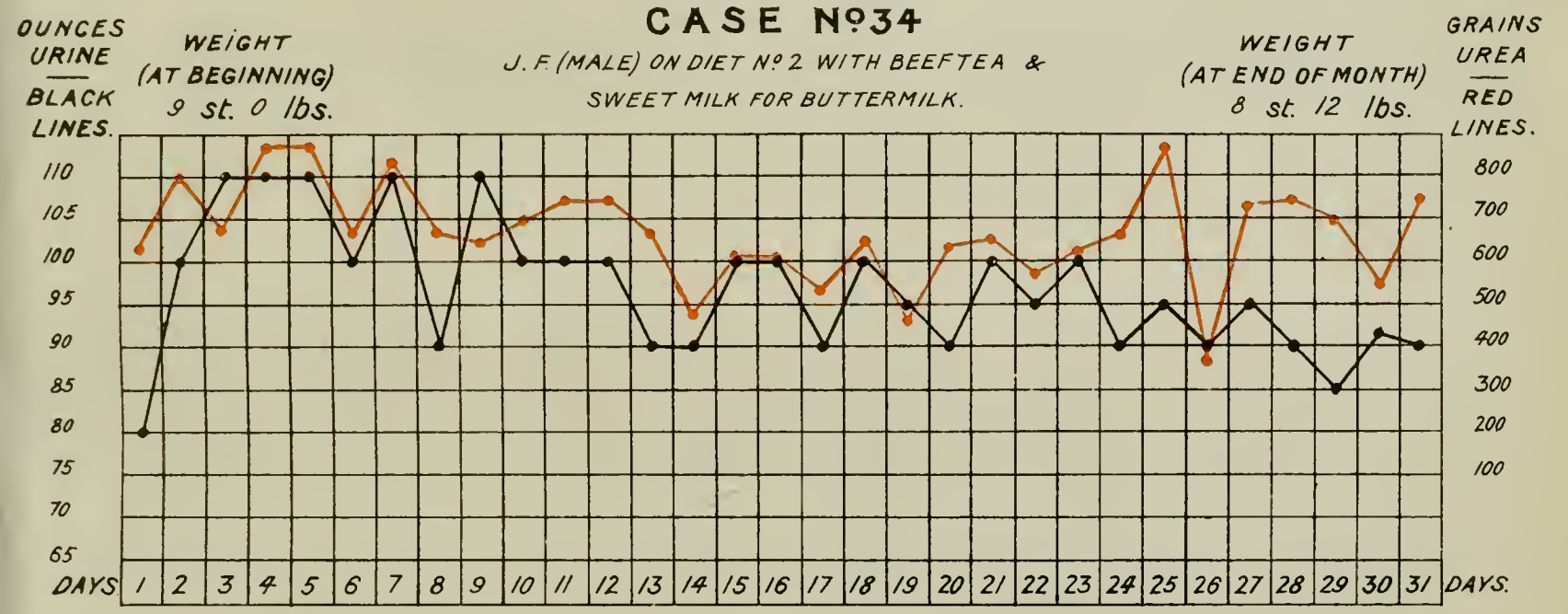
CASE No 33

R.H. (MALE) ON DIET No 2 + BEEF,
WITH 1 PINT SKIMMED MILK FOR 3/4 PINT BUTTERMILK.



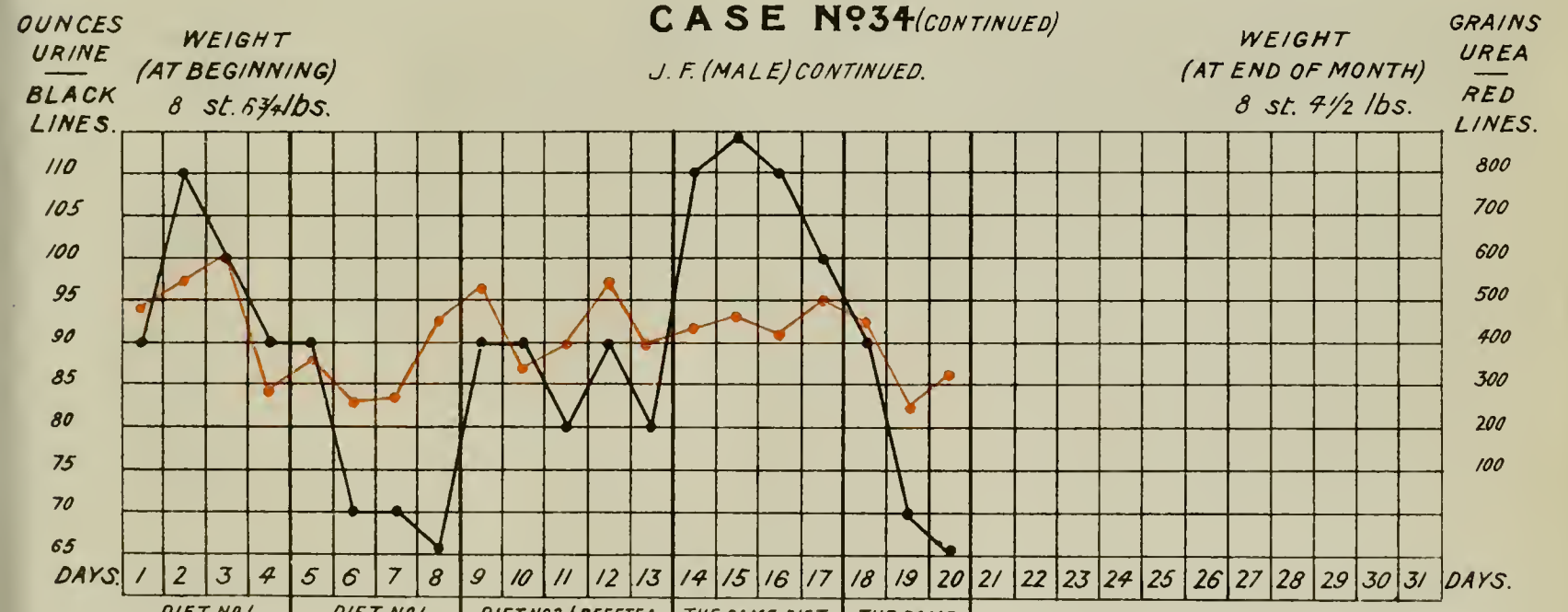
CASE No 34

J. F. (MALE) ON DIET No 2 WITH BEEFTEA & SWEET MILK FOR BUTTERMILK.



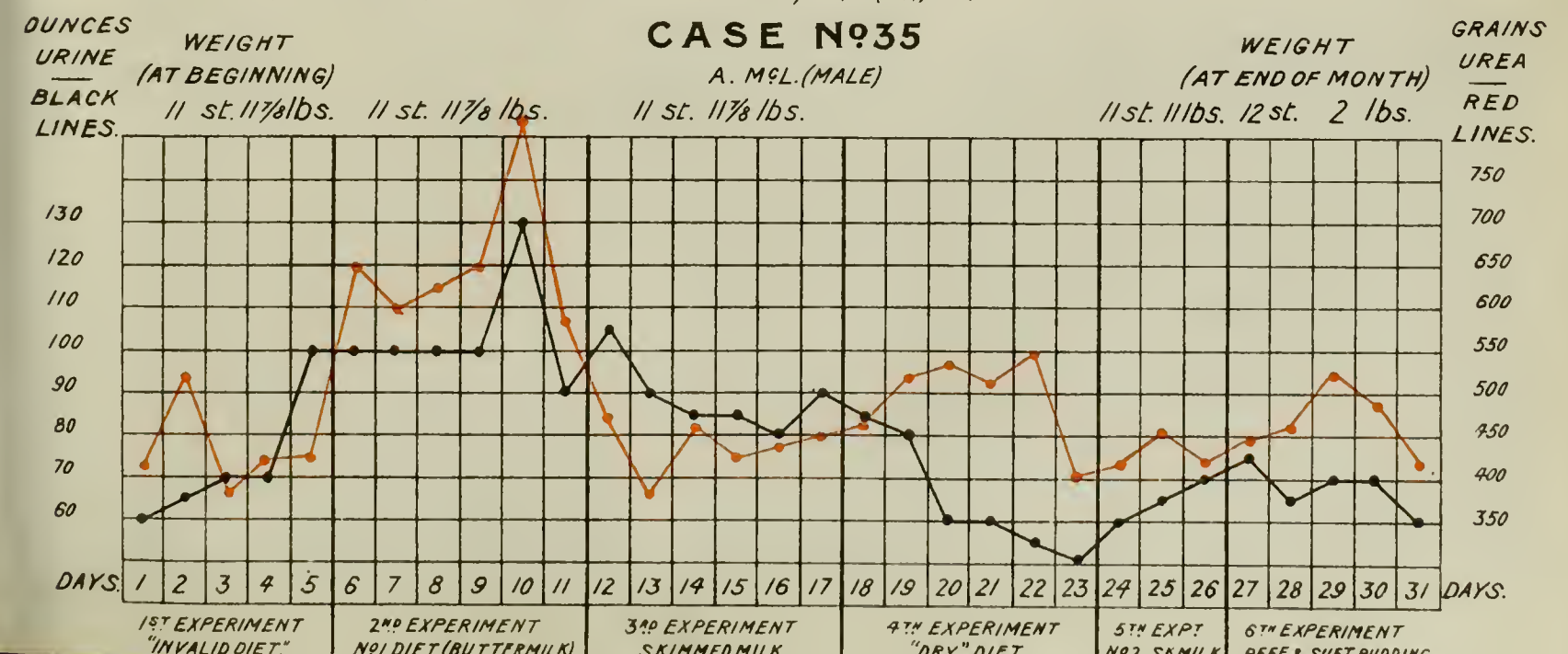
CASE No 34 (CONTINUED)

J. F. (MALE) CONTINUED.



CASE No 35

A. McL. (MALE)



CASE No36

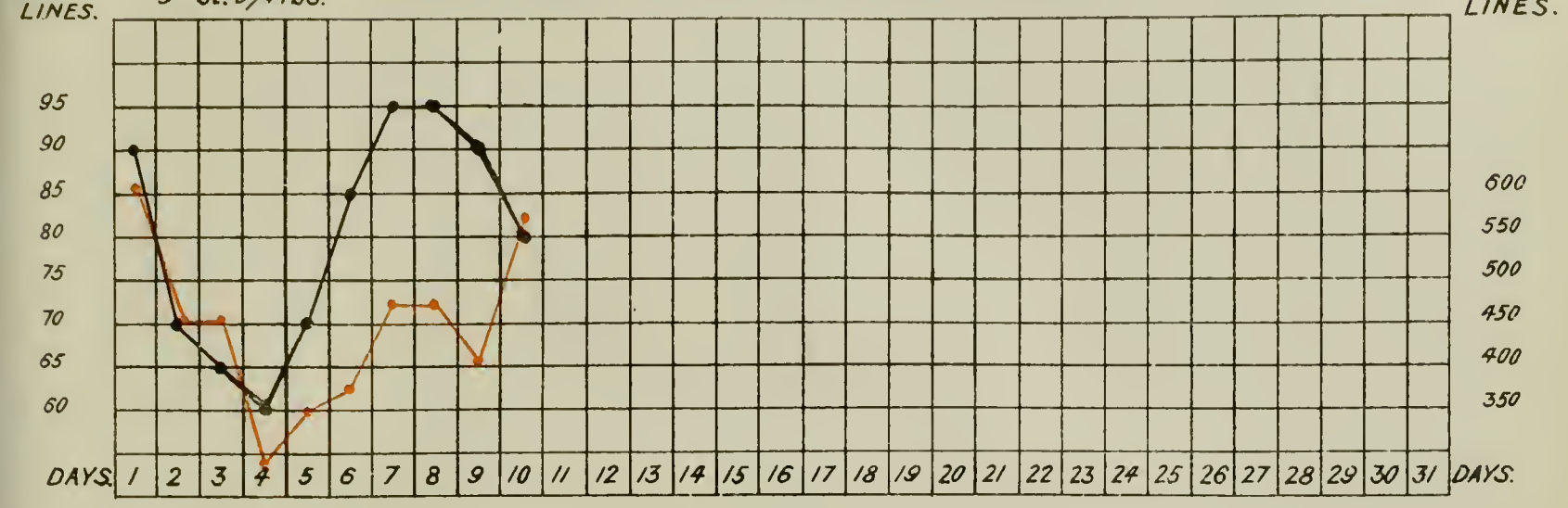
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 0¼ lbs.

A.B. (MALE) ON DIET No1; WITH BREAD, BEEF AND SUET PUDDING FOR DINNER; THEN BROTH FOR THE BEEF.

WEIGHT (AT END OF MONTH) 9 st. 2 lbs.

GRAINS UREA — RED LINES.



CASE No37

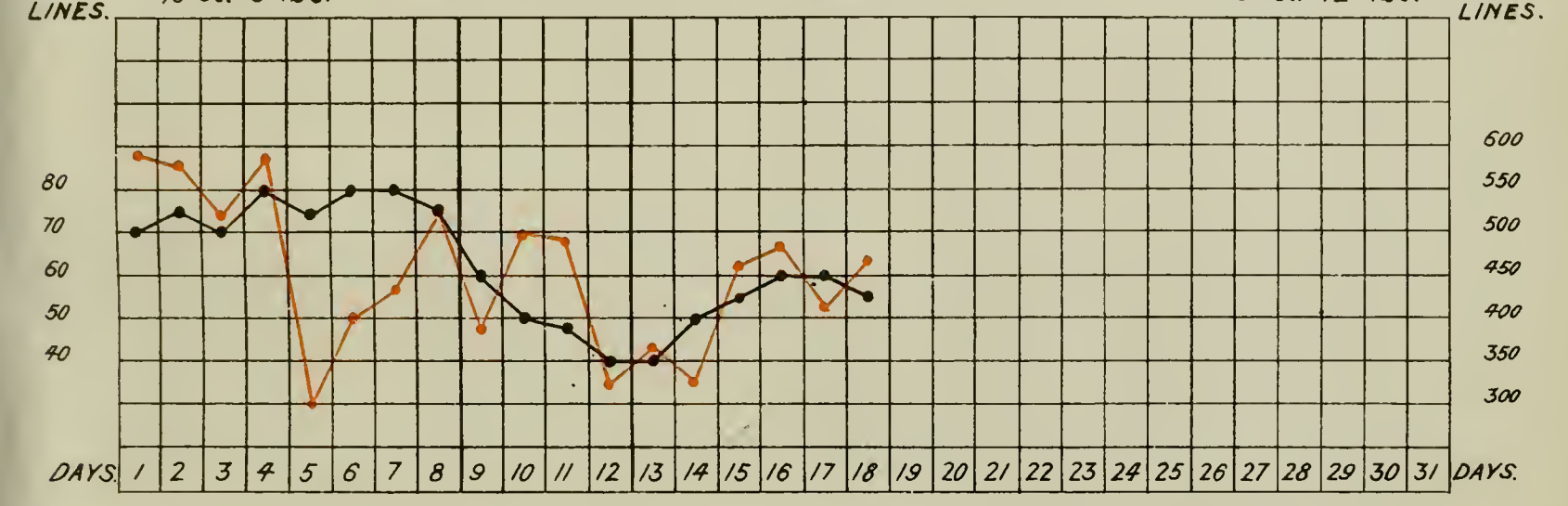
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 3 lbs.

J.M. (MALE) ON DIET No1: THEN ON DIET No1 WITH BREAD, BEEF & SUET PUDDING: THEN BROTH FOR BEEF OF PREVIOUS DIET.

WEIGHT (AT END OF MONTH) 9 st. 12 lbs.

GRAINS UREA — RED LINES.



CASE No38

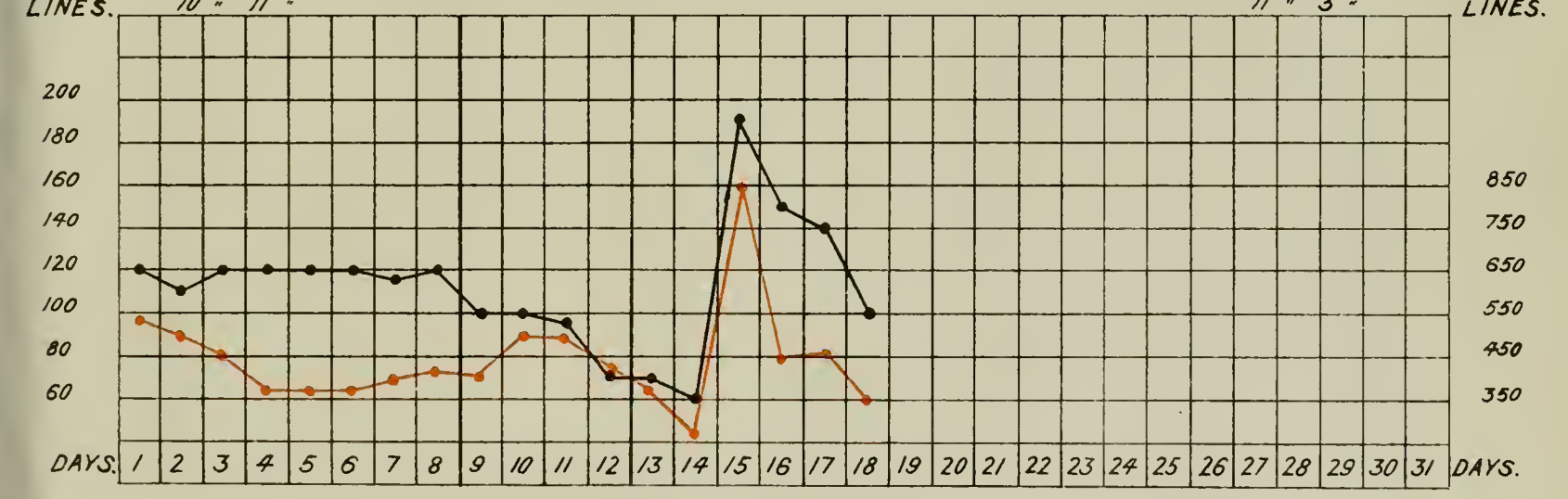
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 12 lbs.
10 " 11 "

C.M. (MALE) ON DIET No1; THEN ON DIET No1 WITH BREAD, BEEF & SUET PUDDING: THEN BROTH FOR BEEF OF PREVIOUS DIET.

WEIGHT (AT END OF MONTH) 11 st. 0 lbs.
11 " 3 "

GRAINS UREA — RED LINES.



CASE No39

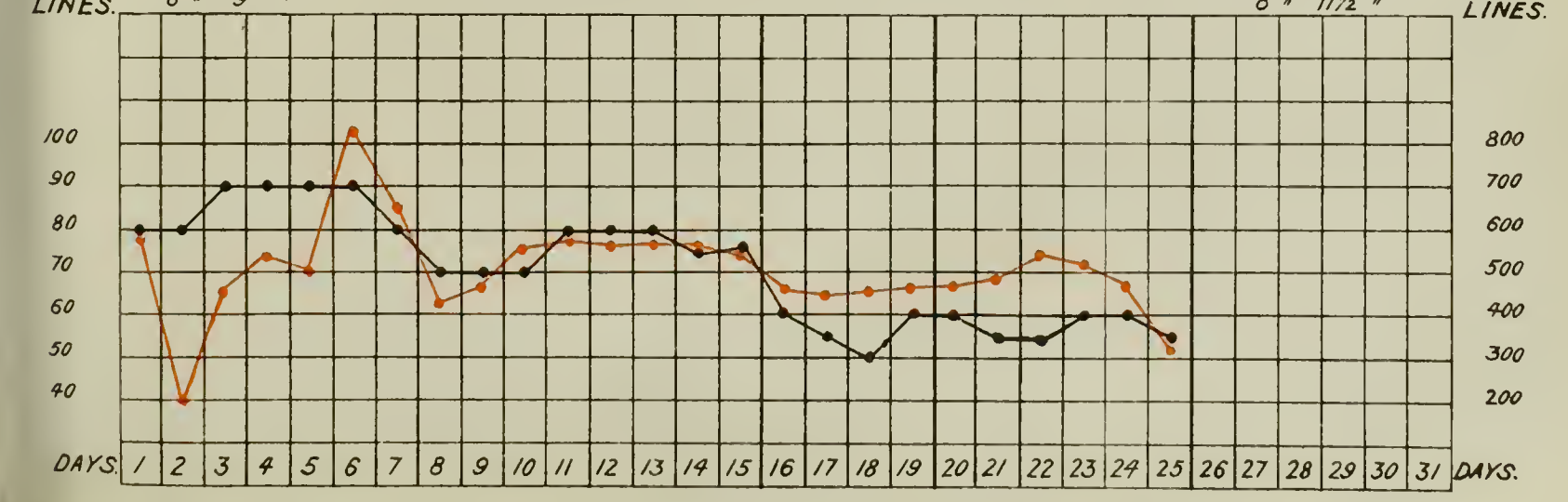
OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 8 st. 10¼ lbs.
8 " 9 "

A.H. (MALE) ON DIET No1; THEN ON DIET No1 WITH SKIMMED MILK, BREAD, BEEF & SUET PUDDING: THEN BROTH FOR BEEF.

WEIGHT (AT END OF MONTH) 8 st. 10½ lbs.
8 " 11½ "

GRAINS UREA — RED LINES.



CASE No 40

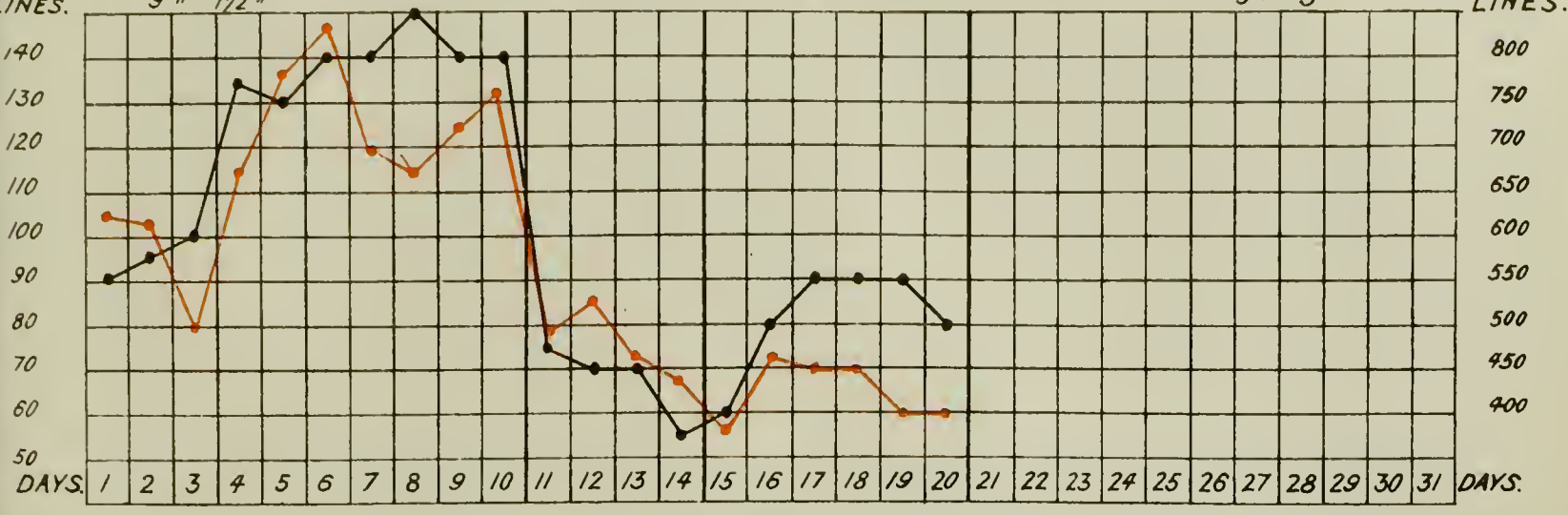
OUNCES URINE. — BLACK LINES.

WEIGHT (AT BEGINNING) 9 st. 6 lbs. 9 " 1½ "

R.W. (MALE) ON DIET No 1: THEN ON DIET No 1 WITH SKIMMED MILK, BREAD, BEEF & SUET PUDDING: THEN BROTH FOR BEEF.

WEIGHT (AT END) 9 st. 3½ lbs. 9 " 3 "

GRAINS UREA — RED LINES.



CASE No 41

OUNCES URINE — BLACK LINES.

WEIGHT (AT BEGINNING) 10 st. 0 lbs. 9 " 11½ "

R.M. (MALE) ON DIET No 1. THEN ON DIET No 1 WITH SKIMMED MILK, BREAD, BEEF & SUET PUDDING: THEN BROTH FOR BEEF.

WEIGHT (AT END) 10 st. 2½ lbs. 10 " 3 "

GRAINS UREA — RED LINES.